



UTAH DEPARTMENT *of*
ENVIRONMENTAL QUALITY

**ENVIRONMENTAL RESPONSE
& REMEDIATION**

PRELIMINARY ASSESSMENT

**900 South 200 West Solvents
Salt Lake County, Utah
UTN000821040**

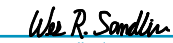
May 2021

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UTN000821040**

Utah Department of Environmental Quality
Division of Environmental Response and Remediation

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1.0 INTRODUCTION

Under authority of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, the Superfund Amendments and Reauthorization Act (SARA) of 1986, in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), and through a Cooperative Agreement with the U.S. Environmental Protection Agency, Region 8 (EPA), the Utah Department of Environmental Quality (UDEQ), Division of Environmental Response and Remediation (DERR) has prepared this Preliminary Assessment (PA) for the **900 South 200 West Solvents**, UTN000821040, (herein referred to as the “Site”) in Salt Lake City, Salt Lake County, Utah.

This PA was initiated because chlorinated solvents, including tetrachloroethene (PCE), trichloroethene (TCE), 1,1-dichloroethene (1,1-DCE), cis-1,2-dichloroethene (cis-1,2-DCE), trans-1,2-dichloroethene (trans-1,2-DCE) and vinyl chloride (VC), have been detected in soil, groundwater, indoor air, and soil gas samples at the Site, beginning in 1999. These hazardous substances were identified through a series of environmental assessments conducted by several private environmental contracting firms on behalf of the property owners.

The purpose of this document is to briefly summarize the results of those previous studies, highlight potentially hazardous conditions, describe any data gaps that limit adequate hazards determination, assess the likelihood of contaminant migration to nearby properties, and determine if it is appropriate to continue site assessment under CERCLA.

2.0 OBJECTIVES

The specific objectives of this work were designed to support a comprehensive assessment of hazardous conditions at the Site based on current understanding. This PA did not aim to collect additional analytical data; rather, it is an assessment of prior work and current conditions. The objectives of this PA were to:

- Assess current and historic conditions at the Site, including any industrial uses;
- Evaluate previously collected Site data, records, and reference materials to identify potential sources of the contamination and assess contaminate migration routes
- Evaluate exposure pathways that might bring people in contact with hazardous substances, potentially affecting human and environmental health; and
- Determine whether the Site warrants further investigation under CERCLA.

3.0 SITE DESCRIPTION

3.1 Site Location and Description

The Site is located in a mixed-use urban setting within Salt Lake City, Salt Lake County, Utah that contains both residential and commercial real estate. The approximate center of the Site is

located at 40.7494047 N, 111.8969997 W. The majority of the properties at the Site are owned by two developers: Dewey 9th, LLC (formerly the Alfandre Family Foundation) and Urban 9th, LLC. The Site includes a vacant, former dry cleaning facility (the Facility) at 906 South 200 West, and nearby parcels along West 900 South, South 200 West, Washington Street, and South 300 West (Figures 1 and 2). This Site is bordered to the south and southwest by residential development. The intersection at 900 South 200 West houses a Utah Transit Authority TRAX rail line and passenger station. Other nearby properties include single family homes, coffee shops, restaurants, and retail stores (Figure 2).

3.2 Site History

3.2.1 906 South 200 West

The Facility is currently vacant, but was previously used as a large dry cleaning business that operated under several different names from the 1920s to 2015, when the most recent occupant, Henrie's Dry Cleaners, closed (Weston Solutions, Inc. 2016a; Wasatch Environmental, Inc. 2018b; Weston Solutions, Inc. 2017b). Two underground storage tanks (USTs) containing a dry cleaning solvent mixture (Stoddard solvent) and an oil-water separator were previously used at the Facility. Those tanks were found to be leaking and were removed in 1990, along with impacted soil in 1992 (SITEX Environmental, Inc. 1992; Weston Solutions, Inc. 2016a; Wasatch Environmental, Inc. 2018b; Weston Solutions, Inc. 2017b). A 1992 Preliminary Site Cleanup Report by SiteX Environmental, Inc., (SITEX Environmental, Inc. 1992), documented that some minor residual ethylbenzene and xylene contamination remained following the excavation and off-site disposal of soil contaminated with Stoddard solvent from the UST basin located near the northwest corner of the Facility. The LUST release was granted regulatory closure in 1996.

During a 1999 subsurface investigation, Granite Environmental, Inc. collected one soil sample on the Facility property that contained tetrachloroethene (PCE) at a concentration of 300 µg/kg (Granite Environmental, Inc. 1999). Although this concentration is below U.S. EPA Regional Screening Levels (RSLs) for residential and industrial soil, this sample was the first confirmation of chlorinated solvent release and impact on the property. Since then, the Facility has been assessed through a series of environmental sampling initiatives conducted by several different environmental firms, including the following:

- Environmental Resources Management prepared an unpublished Indoor Air Sample Analytical Summary in 2015
- Weston Solutions, Inc. prepared a Phase I Environmental Site Assessment (ESA) in August 2016
- Weston Solutions, Inc. prepared an Updated Phase I ESA in April 2017
- Weston Solutions, Inc. prepared a Phase II ESA Addendum in March 2017

- AECOM Technical Services, Inc. prepared an Additional Subsurface Investigation in May 2017
- Wasatch Environmental, Inc. prepared a Potential Tetrachloroethene Source Area Report in April 2018
- Wasatch Environmental, Inc. prepared a Phase I ESA in May 2018
- Wasatch Environmental, Inc. prepared a Source Area Investigation in May 2018
- Wasatch Environmental, Inc. prepared an Additional Site Characterization Report in April 2019
- Wasatch Environmental, Inc. prepared an Additional Site Characterization Report in September 2020

These studies identified chlorinated solvents within soil, groundwater, and soil-gas at concentrations that exceed relevant benchmark values. Wasatch Environmental successfully identified two source areas for chlorinated solvent contamination at the property (Wasatch Environmental, Inc. 2018c). A smaller source area (North Source Area) was identified in association with the Stoddard solvent UST basin near the northwest corner of the Facility, and a larger source area (South Source Area) was identified in association with a drum storage area and dry cleaning equipment located near the west-central portion of the Facility (Appendix C, Figure C-17) (Wasatch Environmental, Inc. 2018c; 2020).

Groundwater samples collected at the Facility between April 2018 and June 2020 measured PCE, trichloroethene (TCE), 1,1-dichloroethene (1,1-DCE), cis-1,2-dichloroethene (cis-1,2-DCE), trans-1,2-dichloroethane (trans-1,2-DCE), vinyl chloride (VC), and benzene at concentrations exceeding U.S. EPA Maximum Contaminant Levels (MCLs) by wide margins (Section 4.2; Appendix C, Table C-11) (Wasatch Environmental, Inc. 2020). Additionally, these concentrations exceed U.S. EPA residential Vapor Intrusions Screening Levels (VISL) target groundwater concentrations, which are groundwater concentrations that could theoretically produce hazardous indoor air conditions based on specific chemical properties.

PCE and TCE were identified in soils at various depths near the South Source Area, at concentrations exceeding RSLs for industrial soils (Section 4.3; Appendix C, Table C-10) (Wasatch Environmental, Inc. 2020). Soil samples collected in 2017 also detected benzo(a)pyrene above its residential RSL, and gasoline range organics (GROs) and diesel range organics (DROs) at concentrations exceeding Utah Initial Screening Levels (Section 4.3). The maximum soil concentration from the property is over 42 times greater than the industrial soil RSL.

Indoor air samples collected from the Facility in 2015 reported PCE above its carcinogenic commercial indoor air RSL (Section 4.3; Appendix C, Table C-1) (ERM 2015). More recent near-slab soil gas samples taken at the north and south end of the Facility reported PCE, TCE,

VC, chloroform, and benzene exceeding residential VISL target sub-slab/near-source gas concentrations, which are soil gas concentrations that could theoretically produce hazardous indoor air conditions based on specific chemical properties (Section 4.3; Appendix C, Table C-6) (Weston Solutions, Inc. 2017a). Wasatch Environmental took soil gas samples approximately 75 feet to the south and southwest of the Facility, reporting chloroform above its residential VISL target sub-slab/near-source gas concentration (Section 4.3; Appendix C, Table C-12) (Wasatch Environmental, Inc. 2019c).

3.2.2 906 South 200 West: Regulatory History, Development, and Recent Impacts

The property owners, represented by James Alfandre, are actively seeking the opportunity to develop the 906 South 200 West property and seven adjacent parcels into a multi-unit, mixed-use residential and commercial space that would provide 275 residential units, 8,900 square feet of commercial space, and 156 parking spaces.

In September 2016, the property at 906 South 200 West was accepted into the Voluntary Cleanup Program (VCP). The VCP applicant, Urban 9th, LLC, withdrew from the VCP in early 2019 and the property owners sought alternative oversight and regulation through the Utah Division of Waste Management and Radiation Control (DWMRC). The DWMRC has worked with both Urban 9th, LLC and Alfandre Family Foundation (Dewey 9th, LLC) representatives since that time.

A Salt Lake City Planning Commission Report dated April 22, 2020 addresses those plans and incorrectly provides the Remedial Action Plan from the VCP program as though it were still valid and planned for implementation, which it is not specifically because the property owners withdrew from the VCP of their own accord (Salt Lake City Planning Commission 2020).

The Facility experienced an extensive fire on September 9, 2020; the cause of which is currently unknown. Buildings within the property experienced significant structural damage and multiple fire crews responded. Fire crews did not detect any additional hazardous materials release during response to the fire (Goodwin 2020). Following the fire, the 906 South 200 West property was fenced off due to extensive damage and the possibility of structural collapse.

On October 8, 2020, a letter from the DWMRC to Joseph Alfandre states the acceptance of the Additional Site Characterization Report for the Former Henries Dry Cleaner, and requests a Corrective Action Plan (CAP) and Risk Assessment (RA) be developed for the property (Utah Division of Waste Management and Radiation Control 2020). The DWMRC agreed with several notable conclusions from the Additional Site Characterization Report, including:

- The lateral and vertical extent of DNAPL (dense non-aqueous phase liquid) has likely been defined in the subsurface

- The DNAPL does not appear to extend much further than 60 ft bgs
- The lateral extent of groundwater in the shallow, intermediate, and deep aquifers has been determined
- The vertical extent of deeper groundwater contaminations has not been defined

The CAP submitted by Wasatch Environmental has been approved by DWMRC (Appendix D). The plan includes *in situ* soil mixing (0 to 7 ft bgs) of the North and South Source Areas with zero-valent iron (ZVI), ZVI injection borings down to 59 ft bgs at the North and South Source Areas, and ZVI permeable reactive barriers (9 to 29 ft bgs) along the northern, western, and southern boundaries of the property. The CAP will only attempt to remediate contamination at the 906 South 200 West property and will not address the full extent of contamination present at the Site.

3.2.3 Other Properties: 221-233 West 900 South; 909-933 Washington Street

The Facility is bordered by several residential, commercial, and mixed-use properties (Figure 2). Seven parcels immediately west of the Facility are also owned by the Dewey 9th, LLC and Urban 9th, LLC, and are part of the residential and commercial development described in section 3.2.2. Current remediation plans at the Site are confined only to the Facility and its parking lot to the south, although contamination has been documented at nearby properties.

Groundwater samples collected from these properties between 2017 and 2020 reported concentrations of PCE, TCE, cis-1,2-DCE, and VC above EPA MCLs and residential VISL target groundwater concentrations (Appendix C, Figure C-8 and Table C-11) (AECOM Technical Services, Inc. 2018; Wasatch Environmental, Inc. 2020). These concentrations provide evidence that groundwater plumes have migrated from the source areas at the facility onto nearby residential and commercial properties.

3.2.4 Physical Conditions – Generalized Hydrogeological and Meteorological Setting

The Site is located in the northern portion of the Salt Lake Valley at an elevation of ~4,246 feet above sea level, on relatively flat ground. Surface water at the Site is largely captured by an engineered urban storm water system that routes water to the Jordan River, about one mile to the west. From there, the Jordan River flows ~12 miles north to the Great Salt Lake (Figure 3). The region is semiarid with average annual precipitation of 15.67 inches per year (Western Regional Climate Center 2016). January high and low average temperatures are 37.3 °F and 20.4 °F, while July values are 92.8 °F and 63.4 °F (Western Regional Climate Center 2016).

The Site resides near a geological contact of young floodplain and stream deposits (Quaternary age); and mixed lacustrine, alluvial, and marsh deposits (Quaternary age) (McKean 2020). These units include moderately to well-sorted sand, silt, clay, clayey silt, and locally may include

gravel and pebbles (McKean 2020). Well logs from the Site corroborate this geology, describing interbedded layers of gravelly sands, coarse- to fine-grained sands, gravelly sands, and low- to non-plastic clays and silts (Wasatch Environmental, Inc. 2020).

Hydrologically, the Salt Lake Valley generally consists of a relatively deep unconfined aquifer near the mountain fronts that becomes confined closer to the valley center due to relatively shallow deposits of silt and clay (Thiros 2003). However, those confining layers are discontinuous and shallower groundwater is, in some places, perched atop the confining layers, and in other places wholly absent (Thiros 2003). The primary recharge area for the deep principal aquifer is along the mountain fronts where the shallow confining layers are absent, allowing for downward flow and aquifer recharge (Thiros 2003).

The Site is located in the north-central portion of the valley, where confining silt and clay layers are common and shallow groundwater is present. Groundwater was encountered at the Site at ~6 to 10 ft bgs (Weston Solutions, Inc. 2016a; AECOM Technical Services, Inc. 2018; Wasatch Environmental, Inc. 2020). Based on well logs and cone penetration tests at the Site, there appear to be at least three aquifers. Hydraulic gradients in the shallow (11-15 ft bgs), intermediate (20-30 ft bgs), and deep aquifers (50-60 ft bgs) are northwest at 0.015 ft/ft, west-northwest at 0.005 ft/ft, and southwest at 0.002 ft/ft, respectively (Wasatch Environmental, Inc. 2020). Intermediate and deep aquifers also consist of an upward vertical hydraulic component (Wasatch Environmental, Inc. 2020). Based on recorded groundwater concentrations and hydraulic gradients, chlorinated solvent plumes have spread from the Facility to properties north-northwest to south-southwest. Appendix C, Figures C-18 through C-20 show estimated extents of chlorinated solvent plumes in the shallow, intermediate, and deep aquifers.

4.0 POTENTIAL EXPOSURE PATHWAYS

4.1 Waste/Source Characteristics

Existing data from the Site indicates the clear presence of hazardous chemicals in soil, groundwater, and soil gas concentrations that exceed appropriate benchmark values. Exposure to volatile organic compounds (VOCs), such as chlorinated solvents or benzene, can result in serious neurological and immunological effects; as well as causing damage or cancers in other organs (Center for Disease Control 2021). The coexistence of PCE, TCE, DCE, and VC in samples is likely due to biological reductive dechlorination, facilitated by reducing conditions in the subsurface (Sims, Suflita, and Russell 1991). The presence of hydrocarbons in the subsurface, such as benzene, can accelerate this process. PCE degradation products are more hazardous than PCE alone, and will continue to increase in concentration as PCE breaks down, posing a serious threat to targets.

A former Stoddard solvent UST basin and a drum storage area at the Facility were identified as sources for the chlorinated solvents (Wasatch Environmental, Inc. 2020; 2018c). Visual inspections at the Facility also reported cracked concrete floors, visible floor staining, and corroded iron sewer lines at the South Source Area (Wasatch Environmental, Inc. 2018c), which may explain how contaminants were discharged to the subsurface. The vertical and lateral extent of DNAPL has been defined at the Site, existing locally, below the Facility (Appendix C, Figures C-14 and C-15) (Wasatch Environmental, Inc. 2020). Groundwater contamination extends from the Facility to nearby properties to the northwest, west, and southwest at various depths (Appendix C, Figures C-18 through C-20) (Wasatch Environmental, Inc. 2020). The vertical extent of groundwater contamination and the extent of subsurface vapor intrusion at the Site remain unknown.

4.2 Groundwater Pathway

Chlorinated solvents were detected in groundwater at the Facility from 2016 through 2020 (Section 3.2.1; Appendix C). Maximum PCE, TCE, 1,1-DCE, cis-1,2-DCE, trans-1,2-DCE, VC, and benzene concentrations detected at the Facility exceed MCLs and VISL target groundwater concentrations for these analytes (Wasatch Environmental, Inc. 2020). PCE, TCE, cis-1,2-DCE, and VC were also detected in groundwater to the northwest, west, and southwest (downgradient) of the Facility from 2016 through 2020 (section 3.2.3; Appendix C). Maximum concentrations reported for these analytes exceed MCLs and residential VISL target groundwater concentrations (Weston Solutions, Inc. 2016a; AECOM Technical Services, Inc. 2018; Wasatch Environmental, Inc. 2020). These values are listed in the table below.

Contaminant	Maximum Detected Groundwater Concentration at Facility [µg/L]	Maximum Detected Groundwater Concentration Downgradient of Facility [µg/L]	Maximum Contaminant Level (MCL) [µg/L]	Residential Vapor Intrusion Screening Level (VISL) Target Groundwater Concentration [µg/L]
PCE	181,000	2,100	5	14.9
TCE	5,120	330	5	1.19
1,1-DCE	505	--	7	195
Cis-1,2-DCE	10,000	1,150	70	<i>No data</i>
Trans-1,2-DCE	154	--	100	109
VC	200	16.9	2	0.147
Benzene	7.12	--	5	1.59

Groundwater contamination has migrated from source areas at the Facility to nearby properties at various depths, as evident in downgradient groundwater concentrations (Wasatch Environmental, Inc. 2020; AECOM Technical Services, Inc. 2018). Appendix C, Figure C-18 reveals that the shallow groundwater plume has spread to the northwest as far as monitoring well MW-100 and to the southwest, nearly to MW-108. Appendix C, Figure C-19 shows that the intermediate plume has migrated west-northwest to the MW-101 and the intersection of 900 South and Washington Street. Appendix C, Figure C-20 indicates that the deep plume has migrated southwest onto nearby mixed-use properties, but not as far as MW-108. The shallow, intermediate, and deep groundwater plumes appear to behave in accordance with hydraulic gradients and groundwater flow directions. Decreased concentrations of chlorinated solvents in upgradient wells provide further evidence that the Facility is the source of chlorinated solvents for the Site. A 2020 hydropunch sample collected at 85-88 ft bgs reported PCE at 29.0 µg/L, above its MCL of 5 µg/L. This indicates that PCE contamination may extend beneath the deep groundwater plume, however more data is needed to fully understand the vertical extent of contamination in groundwater.

4.2.1 Groundwater Exposure Targets and Conclusions

There are ten municipal drinking water supply wells located within a four-mile radius of the site (Figure 4), serving three water supply systems that serve a population of 137,599. The municipal groundwater well closest to the Site is Salt Lake City's 4th Avenue well, located upgradient ~1.8 miles north-northeast of the site (Figure 4). The total completed depth of this well is 464 feet bgs (Utah Division of Water Rights 2021). The closest downgradient well is the Taggart #16 well, located ~2.9 miles to the southwest (Figure 4) (Utah Division of Drinking Water 2019). The depth of this well is 736 feet bgs (Utah Division of Water Rights 2021). There are existing rights to 1,479 underground Points of Diversion (PODs) located within four miles of the Site, some of which list "domestic" or "municipal" as a well use (Utah Division of Water Rights 2020). The Site does not fall within any wellhead protection zones (Figure 5). The closest downgradient PODs are located ~1.3 miles west of the Site (Utah Division of Water Rights 2020).

Currently available data definitively indicates the presence of groundwater contamination and suggests the transport of contaminants through groundwater. The lateral extent of contaminant plumes in the shallow, intermediate, and deep aquifers has likely been defined at the Site, along with groundwater gradients in these aquifers (Section 3.2.4). These plumes extend from the Facility onto nearby residential and commercial properties.

The CAP will only address soil and groundwater contamination within the property boundaries of the Facility to a depth of 60 ft bgs (Section 3.2.2) (Wasatch Environmental, Inc. 2021). With

groundwater contamination present at greater depths and beyond property boundaries, remediation attempts will not likely address the full extent of contaminant plumes at the Site.

Known drinking water resources are likely outside the range of this contamination, but more information is needed to fully assess the groundwater dynamics and vertical extent of contaminants at the Site, especially below 60 ft bgs. Downgradient PODs could potentially be impacted by the groundwater plume, but it is doubtful that PODs are currently being used for drinking water as municipal drinking water is readily available. Exposure through drinking water appears to be unlikely, albeit possible. The primary concern with the contaminant plume is the risk of subsurface vapor intrusion to residential and commercial targets.

4.3 Soil Exposure and Subsurface Intrusion Pathway

Several VOCs, including PCE and TCE, were detected in soil near the South Source area at maximum concentrations of 4,210,000 µg/kg and 7,380 µg/kg, respectively— greatly exceeding industrial RSLs [*PCE* = 100,000 µg/kg; *TCE* = 6,000 µg/kg] (Appendix C, Table C-10) (Wasatch Environmental, Inc. 2020). Benzo(a)pyrene, GROs, and DROs were detected in soil near the North Source area at concentrations of 100 µg/kg, 500,000 µg/kg, and 21 µg/kg, respectively— also exceeding relevant benchmark values [*benzo(a)pyrene residential RSL* = 16 µg/kg; *GRO Utah Initial Screening Level* = 150,000 µg/kg; *DRO Utah Initial Screening Level* = 0.5 µg/kg] (Appendix C, Table C-4) (Weston Solutions, Inc. 2017a). The extent of soil contamination at the Site has been defined, and does not appear to extend beyond the Facility property (Wasatch Environmental, Inc. 2020). The current CAP plans to mix contaminated soils *in situ* with zero-valent iron (ZVI), which acts as an electron donor and dechlorinates chlorinated solvents into ethane and free chloride ions (Wasatch Environmental, Inc. 2021). Even if remediation attempts are successful, groundwater plumes still may pose a threat of subsurface vapor intrusion to nearby properties.

Once volatilized, VOCs can escape from groundwater or interstitial spaces between soil particles and move upward through both soil and building materials, becoming concentrated in indoor air and harming people who live or work in those conditions (Section 4.2.1). Indoor air samples collected from the Facility in 2015 reported PCE above its EPA carcinogenic commercial indoor air RSL (Appendix C, Table C-1) (ERM 2015). Near-slab soil gas samples collected at the north and south end of the Facility reported PCE, TCE, VC, chloroform, and benzene above residential VISL target sub-slab/near-source soil gas concentrations (Appendix C, Table C-6 and C-12) (Weston Solutions, Inc. 2017a). These indoor air and near-slab soil gas sample results are listed in the table below. Additionally, one soil gas sample collected in 2019 at a property ~75 yards to the southwest of the Facility detected chloroform at 12 µg/m³—exceeding the residential VISL target sub-slab/near source gas concentration of 4.7 µg/m³ (Appendix C, Table C-12) (Wasatch Environmental, Inc. 2019c).

Contaminant	Maximum Detected Indoor Air Concentration at Facility [$\mu\text{g}/\text{m}^3$]	Maximum Detected Soil Gas Concentration at Facility Boundary [$\mu\text{g}/\text{m}^3$]	Carcinogenic Commercial Indoor Air Regional Screening Level (RSL) [$\mu\text{g}/\text{m}^3$]	Residential Vapor Intrusion Screening Level (VISL) Target Sub-Slab/Near-Source Concentration [$\mu\text{g}/\text{L}$]
PCE	82	4,000	47	360
TCE	--	94	47	15.9
VC	--	4,000	2.8	5.6
Chloroform	--	39	0.53	4.7
Benzene	--	21	1.6	12

4.3.1 Soil and Subsurface Intrusion Pathway Targets and Conclusions

There are several single- and multi-family residences to the east, south, and west of the vacant Facility (Figure 2), along with several operating businesses, including The Shop Barber Shop & Salon, Central Water, Inc., and Matsuura Printing. The number of people living or working at these buildings is unclear, but approximately 3,163 people live within one-quarter mile of the Site (U.S. Census Bureau 2010). These people are potential targets to subsurface vapor intrusion.

Contaminated soil at the Site lies within the property boundaries of the vacant Facility, is covered by concrete, and presents little risk as a pathway to potential targets. The primary pathway of concern at the Site is the subsurface vapor intrusion from VOCs in groundwater plumes that have migrated to properties northwest, west, and southwest of the Facility. Chlorinated solvents, including PCE, TCE, cis-1,2-DCE, and VC, are present in groundwater at these properties above residential VISLs. No indoor air samples, and only two soil gas samples, have been collected at off-Facility properties. Residential and commercial properties could potentially be exposed to hazardous indoor air conditions. Additional sampling is needed to make that determination because not enough information currently exists to do so. More subsurface soil, soil gas (sub-slab or near-slab), and indoor air samples are needed to accurately assess the risk of subsurface vapor intrusion to these properties.

4.4 Surface Water Pathway

Surface water at the site flows to nearby storm drains and runs about one mile west to the Jordan River, which then flows ~12 miles north towards wetland areas and the Great Salt Lake (Figure

3). There are no surface derived drinking water sources within 15 downstream miles (Utah Division of Drinking Water 2019). Portions of the Site fall within the 500-year flood hazard area (FEMA 2012). The likelihood of exposure via surface water is low because surface water at the Site is extremely ephemeral and not likely to interact with contaminant sources.

4.5 Air Pathway

The Site area is largely covered with asphalt or concrete with little opportunity for site wastes to expose persons through the air. There are approximately 3,163 people living within one-quarter of a mile of the Site and approximately 199,891 persons living within four miles (U.S. Census Bureau 2010). The nearest residential buildings are located ~25 yards to the south of the Facility. There does not appear to be an active or ongoing release at the Site via the air exposure pathway based on the available information. No outdoor air samples have been collected at the Site so far. There is little potential for exposure to Site wastes through the air. Exposure through outdoor air is not probable.

5.0 SUMMARY AND CONCLUSIONS

A chlorinated solvent groundwater plume exists in the vicinity of 900 South 200 West in Salt Lake City, Utah. An assessment of historical records and evaluation of data from several private environmental assessments indicate that hazardous substances exist in soil, groundwater, indoor air, and soil gas at concentrations that warrant further investigation. Contamination at the Site can be attributed to two source areas at the Facility, located at 906 South 200 West. A North Source Area was identified in association with the Stoddard solvent underground storage tank basin near the northwest corner of the facility, and a South Source Area was identified in association with a drum storage area and dry cleaning equipment located near the west-central portion of the Facility. Property owners of the Facility are working with Utah DWMRC to address contamination at the Facility; however, remediation attempts will only address contamination contained within the property boundaries of the Facility.

The extent of soil contamination at the Site has been defined and lies within property boundaries of the Facility. Groundwater contamination is present in the shallow, intermediate, and deep aquifer, and has migrated onto properties to the northwest, west, and southwest of the Facility, following local hydraulic gradients. The lateral extent of groundwater plumes has likely been defined, but the vertical extent remains uncertain. The migration of VOC contaminant plumes onto residential and commercial properties may be exposing humans to hazardous indoor air conditions as a result of subsurface vapor intrusion.

Further information is needed to evaluate contamination at the Site, particularly contamination outside of the Facility property boundaries. The DERR recommends additional sampling and analysis of soil gas and indoor air at nearby properties around the Facility. Such a sampling

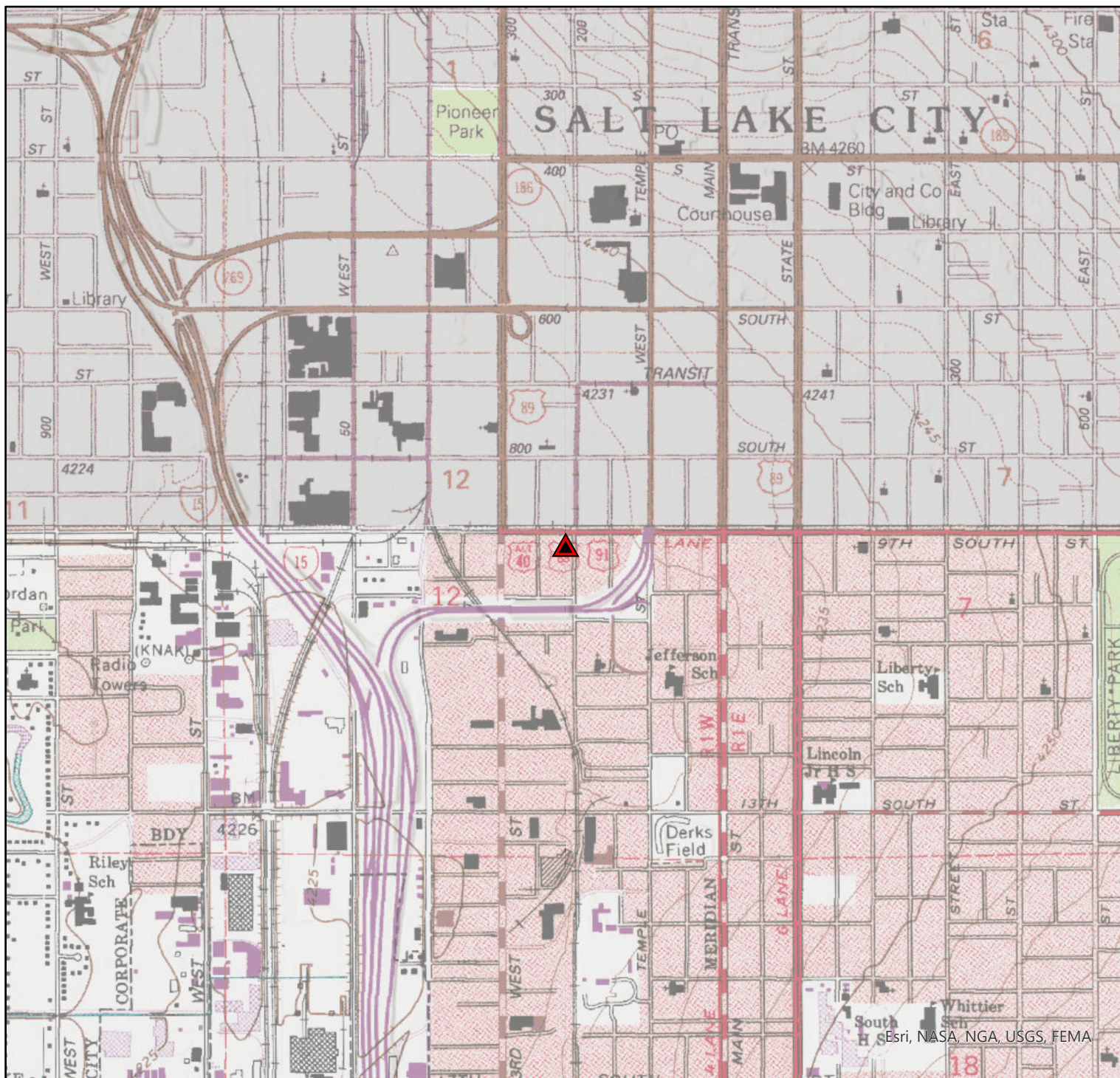
procedure will fill data gaps and help develop strategies to safeguard both human health and environment.

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- Weston Solutions, Inc. 2017b. "Updated Phase I Environmental Site Assessment for Henrie's Dry Cleaners, 906 South 200 West, Salt Lake City, Utah, 84101."

FIGURES



Legend

 Site Location

0 0.13 0.25 0.5 Miles



Latitude/Longitude Documentation Form

Site Name: 900 South 200 West Solvents
 SEMS ID: UTN000821040
 Latitude: 40.7494713
 Longitude: -111.8975535
 Projected Coordinate System:
 WGS 1984 Web Mercator (auxiliary sphere)

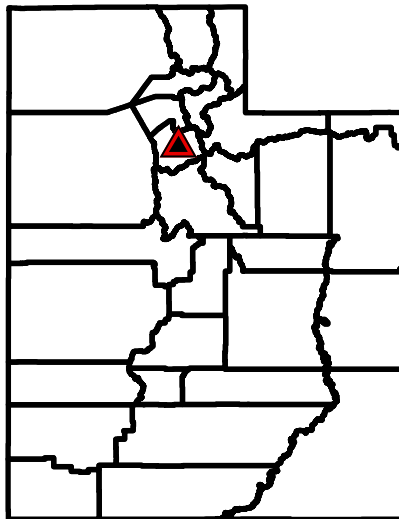


Figure 1

Site Location Map
 900 South 200 West Solvents
 906 S 200 W
 Salt Lake City, UT 84101

Prepared by:

Wes Sandlin

Date:






02-18-2021



UTAH DEPARTMENT of
 ENVIRONMENTAL QUALITY
**ENVIRONMENTAL RESPONSE
 & REMEDIATION**



Legend

-  Site Location
-  Mixed-use properties
-  Residential properties
-  Commercial properties
-  Source property

0 62.5 125 250 375 500
Feet



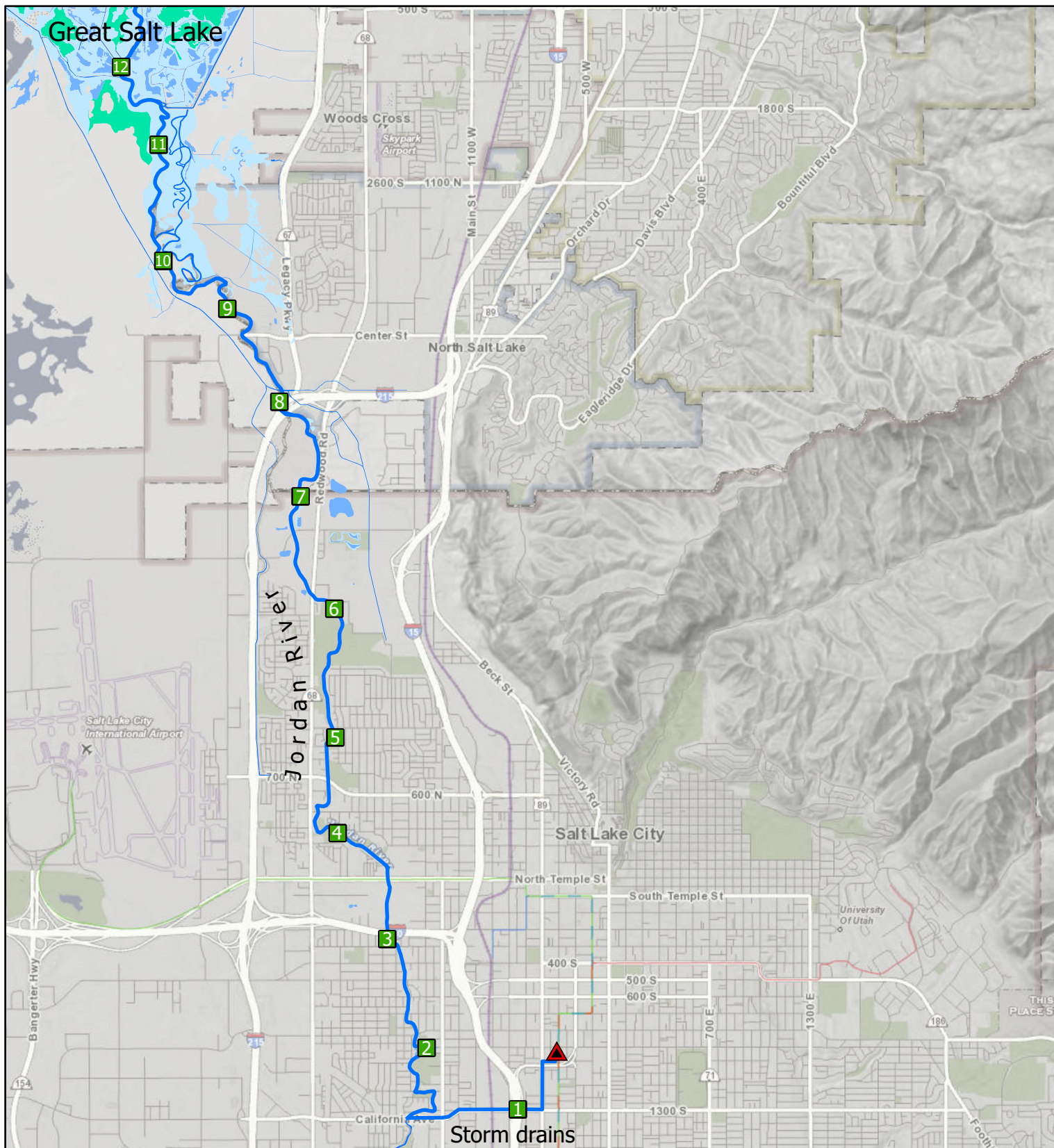
Figure 2

Detailed Site Map
900 South 200 West Solvents
906 S 200 W
Salt Lake City, UT 84101

Prepared by:
Wes Sandlin
Reference Scale:
1:2,000

Date:
02-18-2021
SEM ID:
UTN000821040





Legend

- Freshwater Emergent Wetland
- Freshwater Pond
- Lake
- River

- 1 Mile markers
- Site Location

0 0.5 1 2 Miles



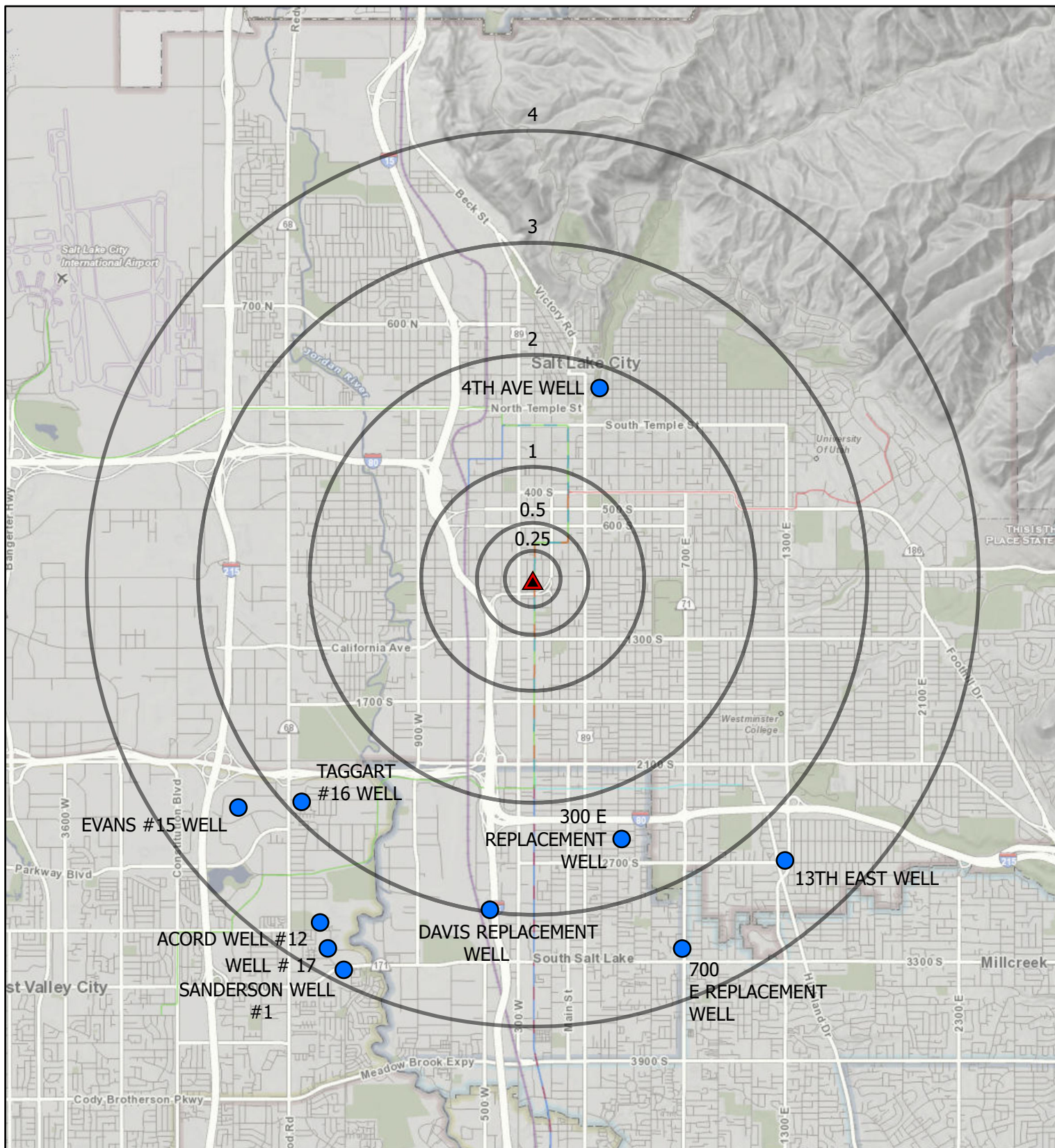
Figure 3

Fifteen Mile Downstream Pathway
900 South 200 West Solvents
906 S 200 W
Salt Lake City, UT 84101




Prepared by:
Wes Sandlin
Reference Scale:
1:100,000

Date:
02-18-2021
SEM ID:
UTN000821040





Legend

-  Site Location
-  Active municipal drinking wells
-  Radial distance rings



0 1 2 4 Miles

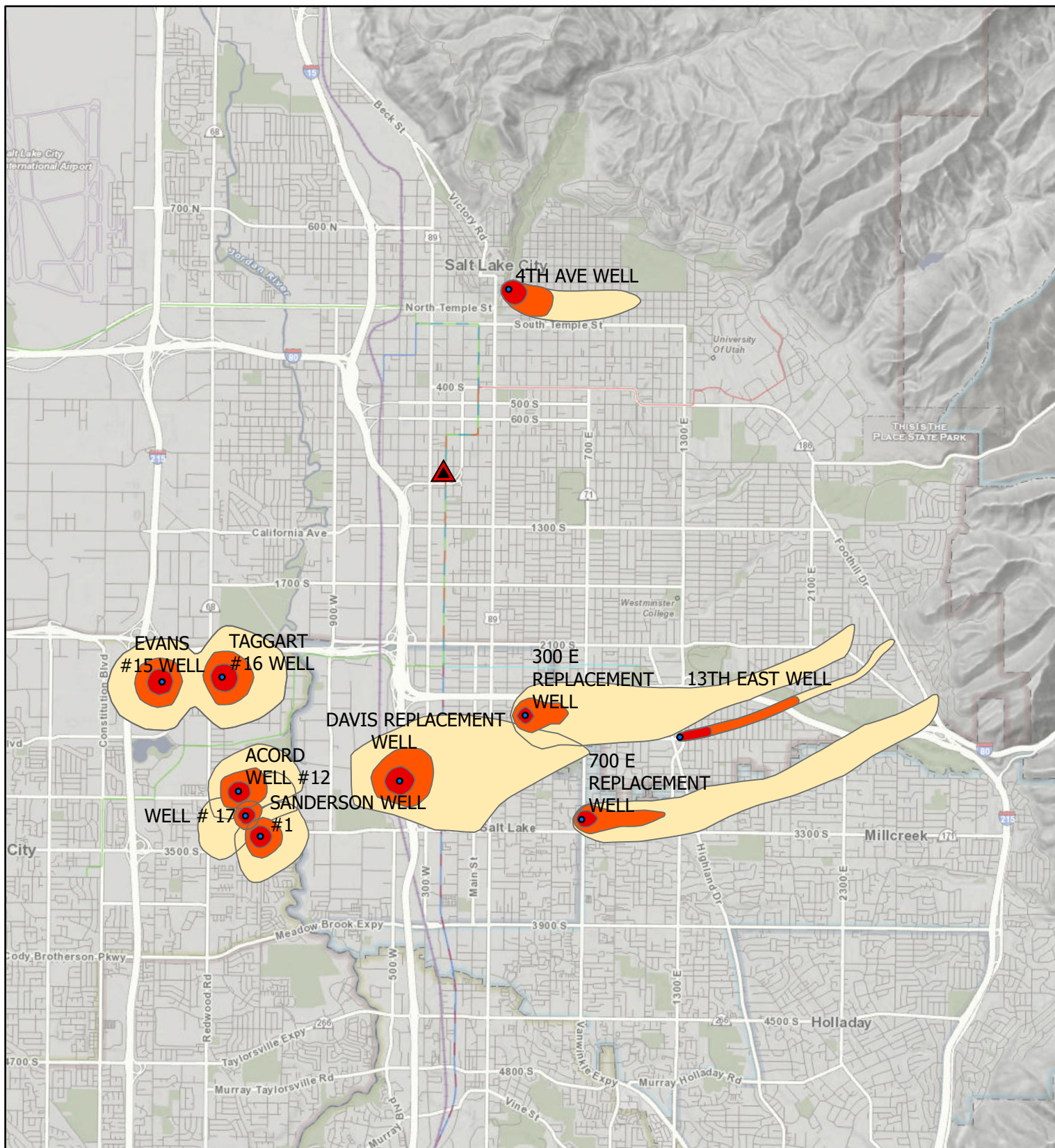
Figure 4

Municipal Wells within Four Miles
900 South 200 West Solvents
906 S 200 W
Salt Lake City, UT 84101



Prepared by:
Wes Sandlin
Reference Scale:
1:100,000

Date:
02-18-2021
SEM ID:
UTN000821040





Legend

-  Site Location
-  Active municipal drinking wells

Protection Zone

-  100 ft
-  250 day
-  3 year
-  15 year

0 0.5 1 2
Miles



Figure 5

Wellhead Protection Zones
900 South 200 West Solvents
906 S 200 W
Salt Lake City, UT 84101

Prepared by:
Wes Sandlin

Date:
02-18-2021

Reference Scale:
1:80,000

SEM ID:
UTN000821040



APPENDIX A

Preliminary Assessment Worksheet

EPA PRELIMINARY ASSESSMENT WORKSHEET

PREPARER'S NAME: Wes Sandlin
SITE NAME: 900 South 200 West Solvents

DATE: February 16, 2021

MAJOR CONSIDERATIONS

- A) DOES ANY QUALITATIVE OR QUANTITATIVE INFORMATION EXIST THAT MAY INDICATE AN OBSERVED RELEASE TO AIR, GROUNDWATER, SOIL OR SURFACE WATER? ☒ YES ☐ NO

Describe: Tetrachloroethene (PCE), trichloroethene (TCE), 1,1-dichloroethene (1,1-DCE), cis-1,2-dichloroethene (cis-1,2-DCE), trans-1,2-dichloroethene (trans-1,2-DCE), vinyl chloride (VC), and benzene were detected in soil, groundwater, and soil gas samples in several studies from 2016 to 2020.

- B) IF THE ANSWER TO #1 IS YES, IS THERE EVIDENCE OF DRINKING WATER SUPPLY CONTAMINATION OR ANY OTHER TARGET CONTAMINATION (i.e. food chain, recreation areas, or sensitive environments)? ☐ YES ☒ NO

Describe: Closest downgradient, municipal drinking wells are nearly 3 miles from the Site. These wells are screened at 642 and 736 ft bgs, which is far below documented groundwater contamination.

- C) ARE THERE SENSITIVE ENVIRONMENTS WITHIN A 4-MILE RADIUS OR 15 DOWNSTREAM MILES OF THE SITE? ☒ YES ☐ NO IF YES, DESCRIBE IF ANY OF THE FOLLOWING APPLY:

Jordan River OHV State Recreation Area, Legacy Nature Preserve, and other sensitive wetlands are present within 15 miles downstream from the site.

1) Multiple sensitive environments? Yes

2) Federally designated sensitive environment(s)? No

3) Sensitive environment(s) downstream on a small or slow flowing surface water body? Yes, there are wetlands present 10 miles downstream from the site, where the Jordan River meets the Great Salt Lake. The Jordan River is considered a warm water fishery.

- D) IS THE SITE LOCATED IN AN AREA OF KARST TERRAIN? ☐ YES ☒ NO

- E) DOES THE WASTE SOURCE LIE FULLY OR PARTIALLY WITHIN A WELLHEAD PROTECTION AREA AS DESIGNATED ACCORDING TO SECTION 1428 OF THE SAFE DRINKING WATER ACT? ☐ YES ☒ NO

Describe: Self-explanatory.

- F) DOES ANY QUALITATIVE OR QUANTITATIVE INFORMATION EXIST THAT PEOPLE LIVE OR ATTEND SCHOOL ON ONSITE CONTAMINATED PROPERTY? ☒ YES ☐ NO

Describe: There are residential homes and apartments at the Site.

SITE INFORMATION

1. SITE NAME: 900 South 200 West Solvents

ADDRESS: 906 South 200 West

CITY: Salt Lake City COUNTY: Salt Lake County STATE: UT

ZIP: 84101 EPA ID: UTN000821040 LATITUDE: 40.7494047 N LONGITUDE: 111.8969997 W

2. DIRECTIONS TO SITE (From nearest public road): To get to the Site, take exit 305C off of I-15. Turn left onto 1300 South, heading east. Turn left onto 300 West, heading north. Turn right on 900 S, heading east. The former Henrie's Dry Cleaners facility will be on the right, at the corner of 900 South and 200 West.

3. SITE OWNERSHIP HISTORY (Use additional sheets, if necessary):

A. Name of current owner: Dewey 9th, LLC (906 South 200 West)

Address: 825 North 300 West, #N141

City: Salt Lake City County: Salt Lake County

State: Utah Zip: 84103 Dates: From 2020 To Present

Phone: _____

Source of ownership data: (Utah Division of Corporations and Commercial Code 2021)

B. Name of previous owner: Urban 9th, LLC (906 South 20 West)

Address: 825 North 300 West, #N141

City: Salt Lake City County: Salt Lake County

State: Utah Zip: 84103 Dates: From 2018 To 2020

Phone: _____

Source of ownership data: (Wasatch Environmental, Inc. 2018b)

C. Name of previous owner: Boyd Henry (906 South 200 West)

Address: 906 South 200 West

City: Salt Lake City County: Salt Lake County

State: UT Zip: 84101 Dates: From 1989 To 2018 (Vacant from 2015-2018)

Phone: _____

Source of ownership data: (Wasatch Environmental, Inc. 2018b)

D. Name of current owner: Urban 9th, LLC (231-233 West 900 S)

Address: 825 North 300 West, #N141

City: Salt Lake City County: Salt Lake County

State: Utah Zip: 84103 Dates: From 2018 To Present

Phone: _____

Source of ownership data: (Utah Division of Corporations and Commercial Code 2021)

E. Name of current owner: Urban 9th, LLC (221 West 900 South)

Address: 825 North 300 West, #N141

City: Salt Lake City County: Salt Lake County

State: Utah Zip: 84103 Dates: From 2018 To Present

Phone: _____

Source of ownership data: (Utah Division of Corporations and Commercial Code 2021)

F. Name of current owner: Urban 9th, LLC (909-927 South Washington Street)

Address: 825 North 300 West, #N141

City: Salt Lake City County: Salt Lake County

State: Utah Zip: 84103 Dates: From 2018 To Present

Phone: _____

Source of ownership data: (Utah Division of Corporations and Commercial Code 2021)

G. Name of current owner: Jose and Rosalba Hernandez (227-229 West 900 South)

Address: 1213 South Ontario Drive

City: Salt Lake City County: Salt Lake County

State: Utah Zip: 84104 Dates: From _____ To _____

Phone: _____

Source of ownership data: (Utah Division of Corporations and Commercial Code 2021)

4. TYPE OF OWNERSHIP (Check all that apply):

☒ Private ☐ State ☐ Municipal ☐ Federal ☐ County

☐ Other (describe):

5. NAME OF SITE OPERATOR: None

Address: _____

City: _____ County: _____

State: __ Zip: _____ Dates: From _____ To _____

Phone: _____

BACKGROUND/OPERATING HISTORY

6. DESCRIBE OPERATING HISTORY OF SITE: From 1926 to 2015 the property at 906 South 200 West was owned and operated by several dry cleaning companies (Chicago Cleaning and Dyeing Company (1926-1933), Paramount Cleaning (1933-1948), Vogue Cleaning (1948-1990), and Henrie's Dry Cleaner (1993-2015)). Dry cleaning operations were unregulated until RCRA regulations went into effect in 1980. Two underground storage tanks containing a dry cleaning solvent mixture (Stoddard solvent) and an oil-water separator were previously used at the Facility. Those tanks were found to be leaking and were removed in 1990, along with impacted soil in 1992. A 1992 Preliminary Site Cleanup Report by Sitex Environmental, Inc., documented that some minor residual ethylbenzene and xylene contamination remained following the excavation and off-site disposal of soil contaminated with Stoddard solvent from the UST basin located near the northwest corner of the Facility. The LUST release was granted regulatory closure in 1996. The facility was left vacant in 2015. Since then, the property has been assessed through a series of environmental sampling initiatives conducted by at least three different environmental firms. The facility, and several several other properties at the Site, are now owned by Dewey 9th and Urban 9th, who are interested in developing multi-use residential and commercial buildings on Site.

Source of information: (SITEX Environmental, Inc. 1992; Weston Solutions, Inc. 2016a; Wasatch Environmental, Inc. 2018b)

7. DESCRIBE THE NATURE OF SITE OPERATIONS (property size, manufacturing, waste disposal, storage, etc.): Chlorinated solvents detected in the soil and groundwater are characteristic of dry cleaning activities that were conducted at 906 South 200 West. Releases may have occurred during operations or during inappropriate disposal. A visual inspection in 2018 identified cracked floors, staining, and corroded sewer lines at a drum storage area in the facility.

Source of information: (Wasatch Environmental, Inc. 2018c)

8. DESCRIBE ANY EMERGENCY OR REMEDIAL ACTIONS THAT HAVE OCCURRED AT THE SITE: Two underground storage tanks containing Stoddard solvent were removed from the facility at 906 South 200 West in 1990, along with impacted soil in 1992 (see 6). Currently, the Utah Division of Waste Management and Radiation Control (DWMRC) is overseeing remediation plans at 906 South 200 West; however, they will not address off-property contamination that is present at the Site.

Source of information: (Wasatch Environmental, Inc. 2021; SITEX Environmental, Inc. 1992)

9. ARE THERE RECORDS OR KNOWLEDGE OF ACCIDENTS OR SPILLS INVOLVING SITE WASTES?
☒ YES ☐ NO

Describe: Chlorinated solvents detected in the soil at the former dry cleaning facility indicate that a spill occurred.

Source of information: (Wasatch Environmental, Inc. 2020)

10. DISCUSS EXISTING SAMPLING DATA AND BRIEFLY SUMMARIZE DATA QUALITY (e.g., sample objective, age/comparability, analytical methods, detections limits and QA/QC): ERM conducted indoor air sampling at the former dry cleaning facility in an unpublished 2015 report. Weston Solutions, Inc. prepared Phase I and Phase II Environmental Site Assessments (ESAs) in 2016 and 2017. Wasatch Environmental, Inc. prepared a number of environmental reports focusing on the facility between 2018 and 2020, including: Phase I and Phase II ESAs, Source Area Investigations, Additional Site Characterization Reports, and a Corrective Action Plan (under review by DWMRC).

Tetrachloroethene (PCE) and trichloroethene (TCE) soil contamination has been reported at various depths at the former dry cleaning facility. PCE concentrations were measured at 311,000 µg/kg (15 ft below ground surface (bgs)) and 4,210,000 µg/kg (21 ft bgs). TCE concentrations were measured at 6,000 µg/kg (7 ft bgs) and 7,380 µg/kg (22 ft bgs). These values exceed EPA RSLs for both industrial and residential soils (PCE Residential = 24,000 µg/kg; PCE Industrial = 100,000 µg/kg; TCE Residential = 940 µg/kg; TCE Industrial = 6,000 µg/kg). Soil samples collected in 2017 detected benzo(a)pyrene, gasoline range organics, and diesel range organics above residential RSLs. The maximum soil value from the property is over 42 times greater than the EPA industrial soil benchmark value.

Groundwater samples collected at the Facility between April 2018 and June 2020 measured PCE at a maximum concentration of 181,000 µg/L (21-25 ft bgs); TCE at a maximum concentration of 5,120 µg/L (20-30 ft bgs); 1,1-dichloroethene (1,1-DCE) at a maximum concentration of 505 µg/L (21-25 ft bgs); cis-1,2-dichloroethene (cis-1,2-DCE) at a maximum concentration of 10,000 µg/L (11-15 ft bgs); trans-1,2-dichloroethene (trans-1,2-DCE) at a maximum concentration of 154 µg/L (11-15 ft bgs); vinyl chloride (VC) at a maximum concentration of 200 µg/L (56-60 ft bgs); and benzene at a maximum concentration of 7.12 µg/L (11-15 ft bgs). EPA Maximum Contaminant Levels (MCLs) for PCE, TCE, 1,1-DCE, cis-1,2-DCE, trans-1,2-DCE, VC, and benzene are 5 µg/L, 5 µg/L, 7 µg/L, 70 µg/L, 100 µg/L, 2 µg/L, and 5 µg/L respectively. EPA residential Vapor Intrusions Screening Levels (VISL) groundwater concentration benchmarks for PCE, TCE, 1,1-DCE, cis-1,2-DCE, trans-1,2-DCE, VC, and benzene are 14.9 µg/L, 1.19 µg/L, 195 µg/L, no data, 109 µg/L, 0.147 µg/L, and 1.59 µg/L respectively. Groundwater concentrations at the facility and nearby properties at the Site exceed MCL and VISL benchmark values by wide margins at various depths.

Indoor air samples collected from the facility in 2015 exceeded industrial RSLs for PCE. Near-slab soil gas samples taken at the north and south end of the Facility reported PCE at a concentration of 4,000 µg/m³, TCE at a concentration of 94 µg/m³, VC at a concentration of 4,000 µg/m³, chloroform at a concentration of 39 µg/m³, and benzene at a concentration of 21 µg/m³. The April 2019 Wasatch Environmental, Inc. took soil gas samples approximately 75 ft to the south and southwest of the Facility, reporting chloroform at a concentration of 12 µg/m³. PCE, TCE, VC, chloroform, and benzene concentrations exceed EPA residential VISL sub-slab/near-source benchmarks (PCE = 360 µg/m³; TCE = 15.9 µg/m³; VC = 5.6 µg/m³; chloroform = 4.7 µg/m³; benzene = 12 µg/m³).

Source of information: (Weston Solutions, Inc. 2017b; 2016b; 2017a; 2016a; ERM 2015; Wasatch Environmental, Inc. 2018c; 2018a; 2018b; 2020; 2019c; 2021)

WASTE CONTAINMENT/HAZARDOUS SUBSTANCE IDENTIFICATION

11. FOR EACH SOURCE AT THE SITE, SUMMARIZE ON TABLE 1 (attached): 1) Methods of hazardous substance disposal, storage or handling; 2) size/volume/area of all features/structures that might contain hazardous waste; 3) condition/integrity of each storage disposal feature or structure; 4) types of hazardous substances handled.
12. BRIEFLY EXPLAIN HOW WASTE QUANTITY WAS ESTIMATED (e.g., historical records or manifests, permit applications, air photo measurements, etc.): The released waste quantity in the subsurface and groundwater cannot be accurately estimated.

Source of information:

13. DESCRIBE ANY RESTRICTIONS OR BARRIERS ON ACCESSIBILITY TO ONSITE WASTE MATERIALS: Entry to the former dry cleaning facility is no longer safe due to the fire in September 2020. Surrounding commercial and residential property will require permission to access.

Source of Information:

GROUNDWATER CHARACTERISTICS

14. IS THERE ANY POSITIVE OR CIRCUMSTANTIAL EVIDENCE OF A RELEASE TO GROUNDWATER?

☒ YES ☐ NO

Describe: Chlorinated solvent contamination in the groundwater was described in previous questions.

Source of information: (Weston Solutions, Inc. 2017b; 2016b; 2017a; 2016a; ERM 2015; Wasatch Environmental, Inc. 2018c; 2018a; 2018b; 2020; 2019c; 2021)

15. ON TABLE 2 (attached), GIVE NAMES, DESCRIPTIONS, AND CHARACTERISTICS OR GEOLOGIC/HYDROGEOLOGIC UNITS UNDERLYING THE SITE.

16. AVERAGE ANNUAL PRECIPITATION: 15.67 inches

Source of information: (Western Regional Climate Center 2016)

SURFACE WATER CHARACTERISTICS

17. ARE THERE SURFACE WATER BODIES WITHIN 2 MILES OF THE SITE?

☐ Ditches ☐ Lakes ☒ Pond ☐ Creeks ☒ Rivers

☐ Other (Describe)

18. DISCUSS THE PROBABLE SURFACE RUNOFF PATTERNS FROM THE SITE TO SURFACE WATERS: Surface water runoff flows into nearby storm drains. Drainage flows west about 1.2 miles to the Jordan River. The Jordan River flows north 12 miles from that point to the Great Salt Lake.

Source of information: (Google Imagery 2020)

19. PROVIDE A SIMPLIFIED SKETCH OF SURFACE RUNOFF AND SURFACE WATER FLOW SYSTEM FOR 15 DOWNSTREAM MILES. See Preliminary Assessment Figure 3.

20. IS THERE ANY POSITIVE OR CIRCUMSTANTIAL EVIDENCE OF SURFACE WATER CONTAMINATION?
☐ YES ☒ NO

Describe: To date, a release from the contaminated soil or plume to surface water has not been detected.

Source of information: NA

21. ESTIMATE THE SIZE OF THE UPGRADIENT DRAINAGE AREA FROM THE SITE: 0 acres

Source of information: NA

22. DETERMINE THE AVERAGE ANNUAL STREAM FLOW OF DOWNSTREAM SURFACE WATERS

Water Body: Jordan River Flow: 138.8 cfs

Source of information: (USGS 2020)

23. IS THE SITE OR PORTIONS THEREOF LOCATED IN SURFACE WATER? ☐ YES ☒ NO

24. IS THE SITE LOCATED IN A FLOODPLAIN ☒ YES ☐ NO (indicate flood frequency)? Portions of the site are located in a 500-year flood zone.

Source of information: (FEMA 2012)

25. IDENTIFY AND LOCATE (see item #35) ANY SURFACE WATER RECREATION AREA WITHIN 15 DOWNSTREAM MILES OF THE SITE: The Jordan River is used for fishing and boating.

26. TWO YEAR 24-HOUR RAINFALL: 1.5 inches

Source of information: (Hershfield 1961)

TARGETS

27. DISCUSS GROUNDWATER USAGE WITHIN FOUR MILES OF THE SITE: Ten wells owned and operated by three public supply systems were identified within the four-mile distance area of the site. There are existing rights to 1,479 underground Points of Diversion (PODs) within four miles of the Site. The uses listed for the underground PODs include domestic, municipal, irrigation, power, stock watering, and "other". No contact was made with the owners of these PODs. Little is known regarding the current activities of these PODs or whether they are using private wells for drinking water purposes.

Source of information: (Utah Division of Water Rights 2020)

28. SUMMARIZE THE POPULATION SERVED BY GROUNDWATER ON THE TABLE BELOW:

DISTANCE (miles)	POPULATION	CUMULATIVE POPULATION
0 - ¼	0	0
¼ - ½	0	0
½ - 1	0	0
1 - 2	13,754	13,754
2 - 3	33,032	46,786
3 - 4	90,813	137,599

Source of information: (Utah Division of Drinking Water 2019)

29. IDENTIFY AND LOCATE (see item #35) POPULATION SERVED BY SURFACE WATER INTAKES WITHIN 15 DOWNSTREAM MILES OF THE SITE: 0

Source of information: (Utah Division of Drinking Water 2019)

30. DESCRIBE AND LOCATE FISHERIES WITHIN 15 DOWNSTREAM MILES OF THE SITE (i.e., provide standing crop of production and acreage, etc.): Surface water flows to the Jordan River, which is a warm water fishery.

Source of information: ("Jordan River Fishing - Utah Rivers & Streams" n.d.)

31. DETERMINE THE DISTANCE FROM THE SITE TO THE NEAREST OF EACH OF THE FOLLOWING LAND USES

Description	Distance (Miles)
Commercial/Industrial/Institutional	<0.01
Single Family Residential	<0.01
Multi-Family Residential	<0.01
Park	0.25
Agricultural	10

Source of information: (Google Imagery 2020; Utah Department of Natural Resources 2019)

32. SUMMARIZE THE POPULATION WITHIN A FOUR-MILE RADIUS OF THE SITE:

DISTANCE (miles)	POPULATION	CUMULATIVE POPULATION
0 - ¼	3,163	3,163
¼ - ½	-	3,163
½ - 1	15,117	18,280
1 - 2	47,869	66,149
2 - 3	68,327	134,476
3 - 4	65,415	199,891

Source of information: (U.S. Census Bureau 2010)

OTHER REGULATORY INVOLVEMENT

33. DISCUSS ANY PERMITS:

County: NA

State: Owners of the former dry cleaning facility located at 906 South 200 West left the Voluntary Cleanup Program (VCP) and requested oversight by Utah Division of Waste Management and Radiation Control (DWMRC) in 2019. The DWMRC has worked with property owners since that time, but are only addressing remediation within the property boundaries and not on the Site as a whole.

Federal: NA

Other: NA

Source of information: (Wasatch Environmental, Inc. 2020)

34. SKETCH OF SITE

Include all pertinent features, e.g., wells, storage areas, underground storage tanks, waste areas, buildings, access roads, areas of ponded water, etc. Attach additional sheets with sketches of enlarged areas, if necessary. See Preliminary Assessment Figures 1 and 2.

35. SURFACE WATER FEATURES

Provide a simplified sketch of the surface runoff and surface water flow system for 15 downstream miles. Include all pertinent features, e.g., intakes, recreation areas, fisheries, gauging stations, etc. - next page. See Preliminary Assessment Figure 3.

TABLE 1

WASTE CONTAINMENT AND HAZARDOUS SUBSTANCE IDENTIFICATION *

SOURCE TYPE	SIZE (volume/Area)	ESTIMATED WASTE QUANTITY	SPECIFIC COMPOUNDS	CONTAINMENT	SOURCE OF INFORMATION
Contaminated soil, groundwater plume	Unknown	Unknown	PCE, TCE, 1,1-DCE, cis-1,2-DCE, trans-1,2-DCE, VC, benzene	None	(Wasatch Environmental, Inc. 2020)

*Use additional sheets if necessary.

** Evaluate containment of each source from the perspective of each migration pathway (e.g., groundwater pathway - non-existent, natural or synthetic liner, corroding underground storage tank; surface water - inadequate freeboard, corroding bulk tanks; air - unstable slag piles, leaking drums, etc.)

TABLE 2

HYDROGEOLOGIC INFORMATION *

STRATA NAME/DESCRIPTION	THICKNESS (ft)	HYDRAULIC CONDUCTIVITY (cm/sec)	TYPE OF DISCONTINUITY**	SOURCE OF INFORMATION
Fill/asphalt	1 foot	Not Available		(Wasatch Environmental, Inc. 2020)
Silty sand, fine to medium grained, unconsolidated	7 feet	Not Available		
Clayey silty sand, unconsolidated	18 feet	Not Available		
Sandy silty clay, unconsolidated	15 feet	Not Available		
Silty clay, unconsolidated	23 feet	Not Available		
Fine sand, unconsolidated	unknown	Not Available		

*Use additional sheets if necessary.

** Identify the type of discontinuity within four-miles from the Site (e.g., river, strata "pinches out", etc.)

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- . 2018b. "Phase I Environmental Site Assessment, Former Henries Dry Cleaning, 906 South 200 West, Salt Lake City, Utah 84104 [Sic]."
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—. 2017a. "Phase II Environmental Site Assessment Addendum for Henrie's Dry Cleaners, 906 South 200 West, Salt Lake City, Utah."

—. 2016b. "Phase II Environmental Site Assessment for Henrie's Dry Cleaners, 906 South 200 West, Salt Lake City, Utah."

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APPENDIX B

CERCLA Eligibility Questionnaire

CERCLA ELIGIBILITY QUESTIONNAIRE

SITE NAME: 900 South 200 West Solvents

CITY: Salt Lake City STATE: Utah

EPA ID NUMBER: UTN000821040

I. CERCLA ELIGIBILITY Yes No

Did the facility cease operation prior to November 19, 1980? ☐ ☒

If answer YES, STOP, facility is probably a CERCLA site.

If answer is NO, Continue to Part II.

II. RCRA ELIGIBILITY Yes No

Did the Facility file a RCRA Part A application? ☐ ☒

If YES:

1. Does the facility currently have interim status? ☐ ☐

2. Did the facility withdraw its Part A application? ☐ ☐

3. Is the facility a known or possible protective filer?
(Facility filed in error). ☐ ☐

4. Type of facility:

Generator ☐ Transporter ☐ Recycler ☐

TSD (Treatment/Storage/Disposal) ☐

Does the facility have a RCRA operating or post closure permit? ☐ ☒

Is the facility a late (after 11/19/80) or non-filer that has been identified by the EPA or the State? (Facility did not know it file under RCRA). ☐ ☒

If all answers to question in Part II are NO, STOP, the facility is a CERCLA eligible site.

If the answer to #2 or #3 is YES, STOP, the facility is a CERCLA eligible site.

If answer #2 and #3 are NO and any OTHER answer is YES, site is RCRA, continue to Part III.

III. RCRA SITES ELIGIBLE FOR NPL Yes No

Has the facility owner filed for bankruptcy under federal or state laws? ☐ ☐

Has the facility lost RCRA authorization to operate or shown probable unwillingness to carry out corrective action? ☐ ☐

Is the facility a TSD that converted to a generator, transporter or recycler facility after November 19, 1980? ☐ ☐

IV. EXEMPTED SUBSTANCES

Does the release involve hazardous substances other than petroleum? ☐ ☐

The site may never reach the NPL. We need to be able to refer it to any other program in EPA or state agencies which may have jurisdiction, and thus be able to effect a cleanup. Responses should summarize available information pertaining to the question.

1) Is there an owner or operator? _____

2) (NPDES-CWA) Is there a discharge water containing pollutants with surface water through a point source (pipe, ditch, channel, conduit, etc.)? _____

3) (Sec. 404-CWA) Have fill or dredged material been deposited in a wetland or on the banks of a stream? Is there evidence of heavy equipment operating in ponds, streams or wetlands? _____

4) (UIC-SDWA) Are fluids being disposed of to the subsurface through a well, cesspool, septic system, pit, etc.? _____

5) (TSCA) Is it suspected that there are PCB's on the site which came from a source with greater than 50 ppm PCB's such as oil from electrical transformers or capacitors? _____

6) (FIFRA) Is there a suspected release of pesticides from a pesticide storage site? Are there pesticide containers on site? _____

7) (RCRA - Subtitle D) Is there an owner or operator who is obligated to manage solid waste storage or disposal units under State solid waste or groundwater protection regulations? _____

8) (UST) Is it suspected that there is a leaking underground storage tank containing a product which is a hazardous substance or petroleum? _____

APPENDIX C

Historical Tables and Figures

Granite, 1999 Report

(No data table or sample location map was included in the original document.)

Granite Environmental, Inc.

Hillside Business Center, Suite 212 • 2469 E. 7000 S. • Salt Lake City, Utah 84121 • (801) 943-1222 • Fax (801) 943-1288

January 13, 1999

Mr. Boyd Henrie
201 W. 900 S.
Salt Lake City, UT.

RE: Phase II Sub-Surface Soil Investigation Located at 201 W. 900 S., and 223 E. 300 S.,
Salt Lake City, UT.

Dear Mr. Henrie:

At your request on December 18, 1998, Granite Environmental Inc. (Granite) performed a sub-surface soil investigation at the above referenced properties. Both properties are established dry cleaning businesses and therefore were sampled for the presence of volatile organic compounds (VOX). The sampling locations were selected by Mr. Henrie where he believed the greatest probability of contamination would be (See Figure 1.)

The soil samples were collected using a Geoprobe® sampling technique at an approximate depth of ten feet below the ground surface. At the 900 S. 200 W. location; the soil sample was taken from within the facility. A four inch diameter hole was cut in the concrete floor of the building, which was approximately four inches thick, to allow for sampling. The soil, at the depth the sample was taken, is a moist brownish clay. No product was encountered during the sampling event. The sample taken from 223 E. 300 S. was located just outside the backdoor of the building. The sampling location is covered by asphalt approximately three inches thick with road base directly below the asphalt. The soil, at the depth the sample was taken, is moist brownish clay. No product was encountered during the sampling event. One soil sample was collected from each location and placed in appropriate labeled containers on ice and immediately delivered to a state certified environmental laboratory under chain-of-custody where they were analyzed for VOX.

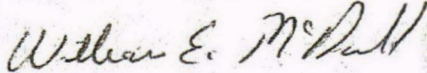
The results of the testing show that Tetrachloroethene, a constituent commonly found in solvents used for dry cleaning, exists at both locations (201 W. 900 S., and 223 E. 300 S.) at 150 parts per billion (PPB) and 300 PPB respectively. Toluene was also detected at 5.6 PPB at the latter property. See attachments for laboratory analytical results.

Contamination by Tetrachloroethene does exist at both property locations. However, Granite cannot determine the amount of contamination from only one soil sample at each location. The sampling locations were chosen based on the highest probability of contamination from dry cleaning solvents and the amount detected was minimal. Therefore it is possible that the amount of contamination is also minimal. If these values are indicative of average levels existing at both sites, Granite believes that the State would not require clean-up even though no threshold value is established.

Thank you for allowing Granite to perform these environmental services for you. If you have any questions, comments, concerns or future projects please call us at (801) 943-1222.

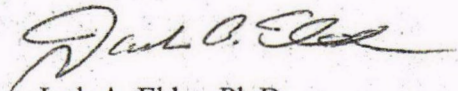
Sincerely,

Granite Environmental Inc.



William E. McDonald
Project Engineer

Reviewed by:



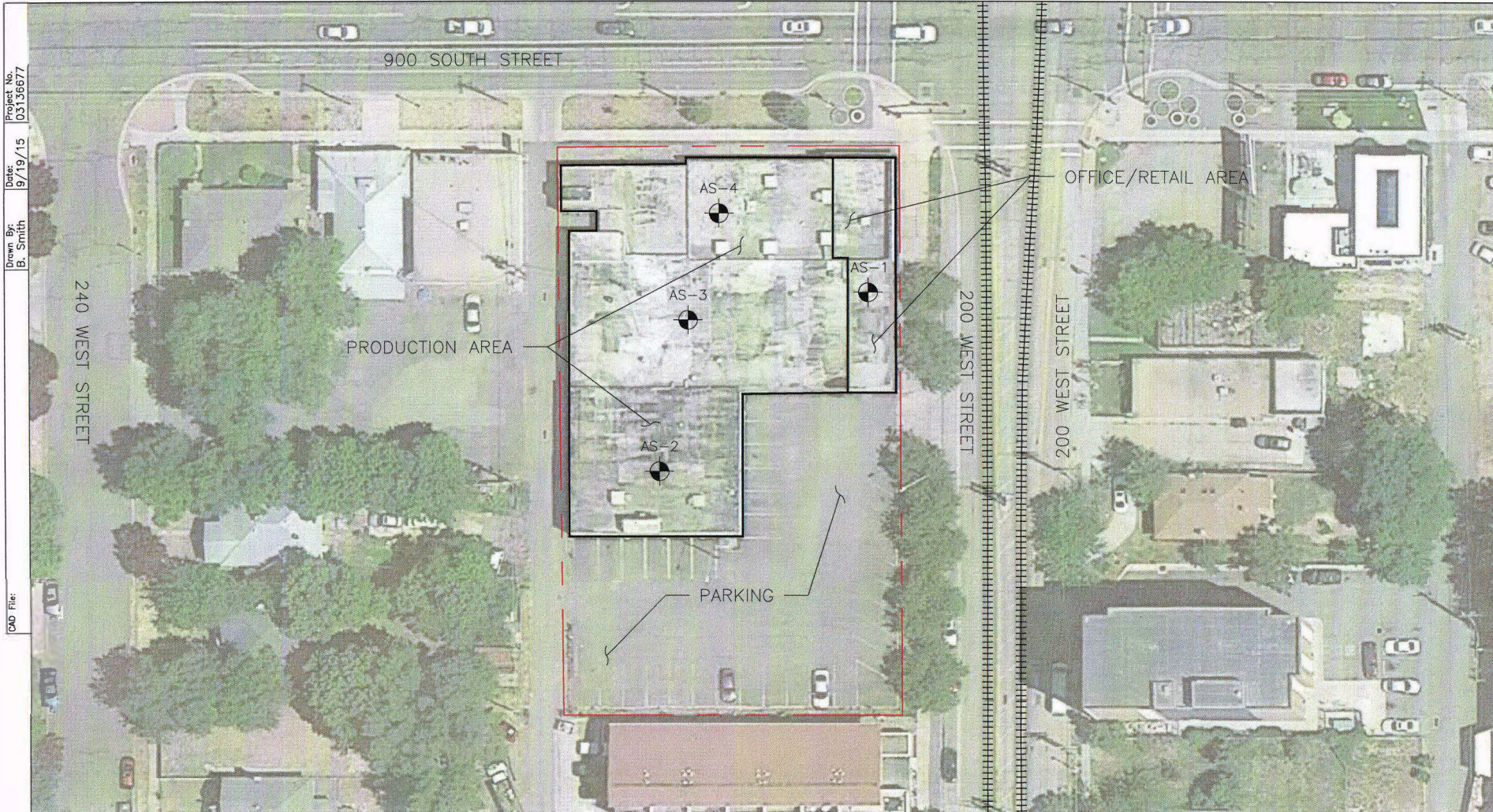
Jack A. Elder, Ph.D.
President

Table and Figure Extracted from ERM, 2015 Unpublished Report

Sample Location	Dichlorodifluoromethane	Chloromethane	Freon 11	Acetone	Methylene Chloride	2-Butanone	cis-1,2 Dichloroethene	Ethyl Acetate	Hexane	Benzene	Cyclohexane	Trichloroethene (TCE)	Heptane	Toluene	Tetrachloroethene (PCE)	Ethylbenzene	m,p-Xylene	o-Xylene	4-Ethyl Toluene	1,3,5-Trimethylbenzene	1,2,4-Trimethylbenzene
AS-1	2.9	1.6	1.6 J	19	< 0.52	0.93 J	< 0.59	< 0.54	1.1 J	0.75 J	< 0.52	< 0.81	0.64 J	3.2	31	0.67 J	3.2	0.80 J	< 0.74	< 0.74	1.2 J
AS-2	3.0	4.2	1.7 J	24	0.64 J	1.9	1.2 J	0.55 J	1.0 J	0.75 J	< 0.52	1.0 J	< 0.61	3.6	82	< 0.65	7.3	0.80 J	< 0.74	< 0.74	1.2 J
AS-3	2.7	1.5	1.5 J	21	< 0.52	2.9	< 0.59	< 0.54	1.3 J	0.94 J	0.52 J	0.83 J	0.80 J	4.1	76	1.1 J	6.9	2.1 J	2.1 J	2.3 J	7.9
AS-4	2.7	1.5	1.6 J	15	< 0.52	0.85 J	< 0.59	< 0.54	1.6 J	0.94 J	0.53 J	< 0.81	0.99 J	5.2	25	0.81 J	4.0	1.3 J	< 0.74	< 0.74	1.3 J
EPA Region 9 RSL for Residential Air	100	94	730	3,200	100	5,200	NS	73	730	0.36	6,300	0.48	NS	5,200	11	1.1	100	100	NS	NS	7.3
EPA Region 9 RSL for Industrial Air	440	390	3,100	140,000	1,200	22,000	NS	310	3,100	1.6	26,000	3.0	NS	22,000	47	4.9	440	440	NS	NS	31

Notes:
Concentrations highlighted in red exceed residential RSL
Underlined concentrations exceed industrial RSL
RSL = Regional Screening Level
J = Estimated concentration. Compound detected between method detection limit and reporting limit
All units in ug/m³
Table shows detected compounds only

Table C-1



CAD File:
 Drawn By:
 B. Smith
 Date:
 9/19/15
 Project No.
 03136677



**ENVIRONMENTAL
 RESOURCES
 MANAGEMENT**

Aerial Source:
 © 2014 Google Earth Pro
 Ver 7.1.2.2041
 Image Date: 6/16/2015

0 35
 Approx. Scale (feet)



INDOOR AIR SAMPLE LOCATION



APPROXIMATE PROPERTY BOUNDARY

Figure C-1
Site Location/Sample Location Map
Henries Cleaners
906 South 200 West
Salt Lake City, Utah

ERM 9/15

Figures and Tables Extracted from Weston, 2017a
(*Weston, 2017a includes data from Weston, 2016b*)



Legend

- ⊙ Soil Boring Location
- ⊕ Monitoring Well Location
- △ Soil Gas Location
- Well Point Location
- BLUE Indicates Groundwater Sample

0 30 60 Feet



Prepared for:
U.S. EPA Region 8



Contract No.:
EP-S8-13-01

TDD:
1605-22

TO:
0003



Prepared By:
Weston Solutions, Inc.
START IV

Suite 100
1435 Garrison Street
Lakewood, CO 80215

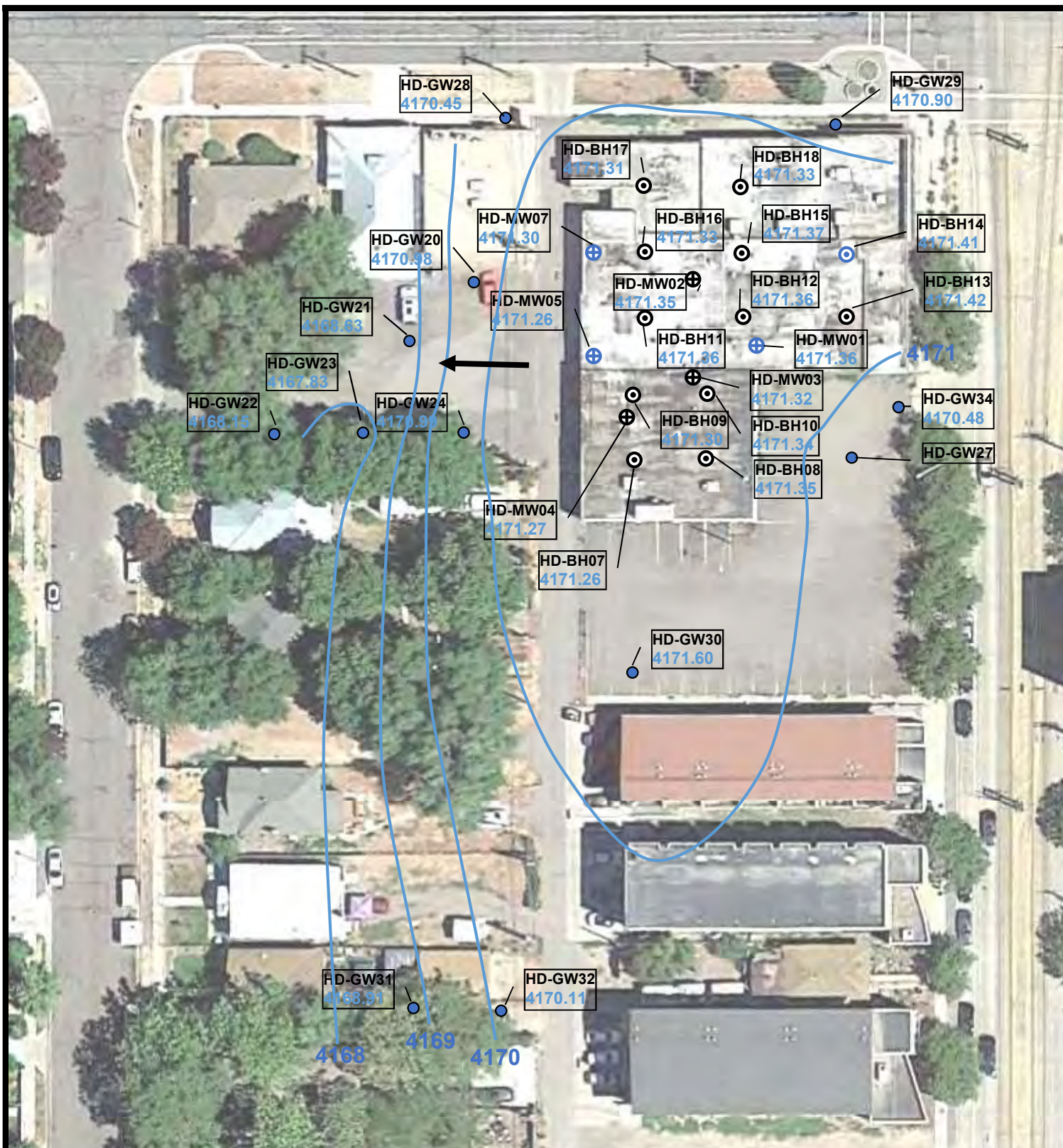
FIGURE C-2

SAMPLE LOCATION MAP

HENRIE'S DRY CLEANERS

SALT LAKE CITY, SALT
LAKE COUNTY, UTAH

DATE: 1/10/2017



Legend

- ⊙/⊕/⊙ Groundwater Elevation Data Point
- 4170.11 Groundwater Elevation Potentiometric Surface Contour
- ➔ Groundwater Flow Direction

0 30 60 Feet



Prepared for:
U.S. EPA Region 8



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0003



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Weston Solutions, Inc.
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Suite 100
1435 Garrison Street
Lakewood, CO 80215

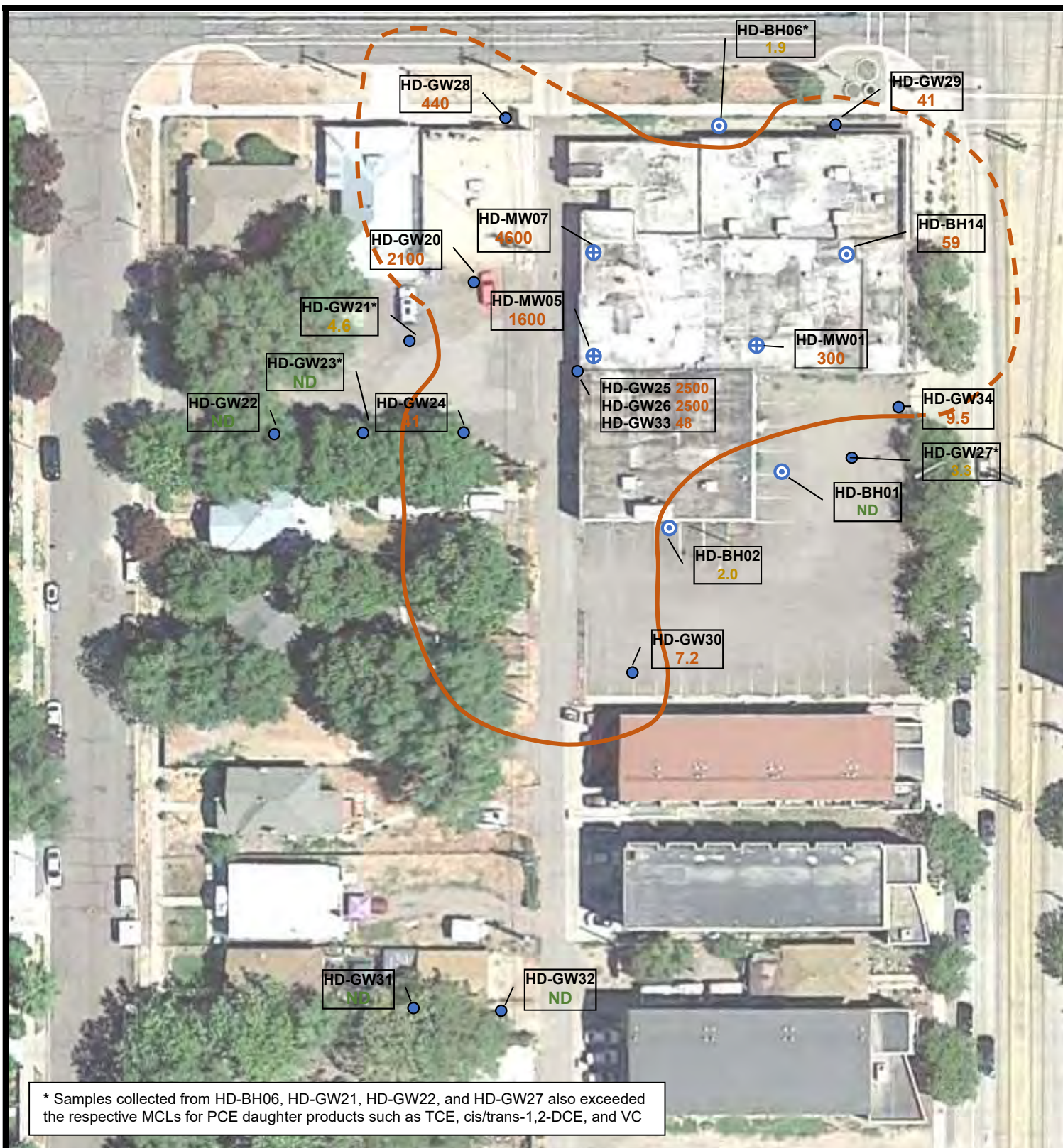
FIGURE C-3

**GROUNDWATER
POTENTIOMETRIC MAP**

HENRIE'S DRY CLEANERS

**SALT LAKE CITY, SALT
LAKE COUNTY, UTAH**

DATE: 1/10/2017



Legend

- Groundwater Sample Location
- PCE Concentration
- Groundwater PCE MCL
- Exceedance Boundary (Dashed where inferred)
- PCE – Tetrachloroethene, MCL – Maximum Contaminant Level, ND – Not Detected
- 0 30 60 Feet



Prepared for:
U.S. EPA Region 8



Contract No.:
EP-S8-13-01

TDD:
1605-22

TO:
0003



Prepared By:
Weston Solutions, Inc.
START IV

Suite 100
1435 Garrison Street
Lakewood, CO 80215

FIGURE C-4

GROUNDWATER PCE
CONCENTRATION MAP

HENRIE'S DRY CLEANERS

SALT LAKE CITY, SALT
LAKE COUNTY, UTAH

DATE: 1/10/2017

Table C-2 : Sample Summary

Henrie's Dry Cleaners - Salt Lake City, UT

Phase II ESA Report

Page 1 of 2

Initial Sampling Event:

Location	Purpose	Sample Name	Media	Analysis	Table Reference
Soil Borings					
HD-BH01	Characterize area down / cross gradient (southeast) of building.	HD-BH01 (0.5-2.5')	Shallow Soil	VOCs, GRO, DRO, SVOCs	C-4
		HD-BH01 (5-7')	Deep Soil	VOCs, GRO, DRO	
		HD-GW-01	Groundwater	VOCs, GRO, DRO, SVOCs	C-5
HD-BH02	Characterize area down gradient (south) of building.	HD-BH02 (1.6-3.6')	Shallow Soil	VOCs, GRO, DRO, SVOCs	C-4
		HD-BH02 (6-8')	Deep Soil	VOCs, GRO, DRO	
		HD-GW-02	Groundwater	VOCs, GRO, DRO, SVOCs	C-5
		HD-GW-02D			
		HD-SG02	Soil Gas	VOCs	C-6
HD-BH03	Characterize area down gradient (southwest) of building.	HD-BH03 (1-3')	Shallow Soil	VOCs, GRO, DRO, SVOCs	C-4
		HD-BH03 (6.5-8.5')	Deep Soil	VOCs, GRO, DRO	
HD-BH04	Characterize area down / cross gradient (southeast) of building.	HD-BH04 (0.8-2.8')	Shallow Soil	VOCs, GRO, DRO, SVOCs	C-4
		HD-BH04 (5.5-8.0')	Deep Soil	VOCs, GRO, DRO	
HD-BH05	Characterize area cross gradient (west) of building.	HD-BH05 (0.6-1.8')	Shallow Soil	VOCs, GRO, DRO, SVOCs	C-4
		HD-BH05 (5.6-8')	Deep Soil	VOCs, GRO, DRO	
		HD-BH05D (5.6-8')			
HD-BH06	Characterize area up gradient (north) of building. Characterize area down gradient (south) of nearby LUST site.	HD-BH06 (7-9')	Shallow Soil	VOCs, GRO, DRO, SVOCs	C-4
		HD-BH06D (7-9')			
		HD-BH06 (11-14')	Deep Soil	VOCs, GRO, DRO	
		HD-GW-06	Groundwater	VOCs, GRO, DRO, SVOCs	C-5
		HD-SG01	Soil Gas	VOCs	C-6
Indoor Sumps					
North Sump	Characterize solids in sump.	HD-SS-01	Solids	VOC, GRO, DRO, SVOCs, RCRA Metals	C-4
South Sump		HD-SS-02			
Monitoring Wells					
HD-MW01	Characterize groundwater within the building foot print. Collect relative groundwater elevation data to determine the hydraulic gradient of the site.	HD-MW-01	Groundwater	VOCs, GRO, DRO, SVOCs, GW depth	C-3 and C-5
HD-MW02		Not Sampled		GW depth	C-3
HD-MW03					
HD-MW04		Not Sampled		Not Analyzed	C-3 and C-5
HD-MW05					
HD-MW06		Not Sampled		Not Analyzed	C-3 and C-5
HD-MW07					
Building Materials					
Various	Determine presence of ACM.	HD-XX-01 through HD-XX-58	Building Materials	PLM	Not shown
Various	Determine presence of LBP.	Not Sampled (Screening Only)	Building Materials	XRF response	Not shown
Various	Determine presence of other potentially hazardous materials.	Not Sampled (Screening Only)	Various	Not Analyzed (Photos Provided in Appendix)	Not Shown

Table C-2 : Sample Summary

Henrie's Dry Cleaners - Salt Lake City, UT

Phase II ESA Report

Page 2 of 2

Supplemental Sampling Event:

Location	Purpose	Sample Name	Media	Analysis	Table Reference
Soil Borings					
HD-BH07	Characterize sub slab soil.	HD-BH07 (8.0-10.0')	Soil	VOCs, GRO, DRO, SVOCs	C-4
HD-BH08		HD-BH08 (8.0-10.0')			
HD-BH09		HD-BH09 (0.4-2.4')			
HD-BH10		HD-BH10 (8.0-12.0')			
HD-BH11		HD-BH11 (0.8-1.8')			
HD-BH12		HD-BH12 (8.0-10.8')			
HD-BH13		HD-BH13 (8.0-11.0') and HD-BH13D (8.0-11.0')			
HD-BH14	Characterize sub slab soil and delineate groundwater impacts.	HD-BH14 (8.0-10.0')	Groundwater	VOCs	C-3 and C-5
HD-BH15	Characterize sub slab soil.	HD-BH15 (0.3-2.8')			
HD-BH16		HD-BH16 (0.3-2.7')			
HD-BH17		HD-BH17 (8.0-11.1') and HD-BH17D (8.0-11.1')			
HD-BH18		HD-BH18 (8.0-10.0')			
HD-BH19		HD-BH19 (8.0-10.0')			
Well Points					
HD-GW20	Delineate groundwater impacts.	HD-GW20	Groundwater	VOCs	C-3 and C-5
HD-GW21		HD-GW21			
HD-GW22		HD-GW22			
HD-GW23		HD-GW23			
HD-GW24		HD-GW24			
HD-GW25		HD-GW25 and HD-GW25D			
HD-GW26		HD-GW26			
HD-GW27		HD-GW27 and HD-GW27D			
HD-GW28		HD-GW28			
HD-GW29		HD-GW29			
HD-GW30		HD-GW30			
HD-GW31		HD-GW31			
HD-GW32		HD-GW32			
HD-GW33		HD-GW33			
HD-GW34		HD-GW34			

Notes: VOC - Volatile Organic Compound, SVOC - semi VOC, GRO - Gasoline Range Organics, DRO - Diesel Range Organics, RCRA - Resource Conservation and Recovery Act,

GW - groundwater, ACM - Asbestos Containing Materials, PLM - Polarized Light Microscopy, LBP - Lead Based Paint, XRF - X-Ray Fluorescence

Sample Names: D - indicates the sample is a duplicate of the previously listed sample. XX - is a stand in for abbreviations of various building materials (e.g. DW = dry wall)

Table C-3 : Groundwater Elevation and Water Quality Summary

Henrie's Dry Cleaners - Salt Lake City, UT

Phase II ESA Report

Initial Sampling Event:

	HD-MW01	HD-MW02	HD-MW03	HD-MW04	HD-MW05	HD-MW07	HD-GW01	HD-GW02	HD-GW05	HD-GW06
Groundwater Elevation Data										
TOC Elevation (ft.)	4178.59	4178.58	4178.60	4178.65	4178.66	4172.49	4178.35	4179.19	4178.62	4178.39
Depth to Water (ft. below TOC)	7.76	7.77	7.85	7.94	7.96	8.16	8.48	8.98	8.30	8.74
Relative Groundwater Elevation (ft.)	4170.83	4170.81	4170.75	4170.71	4170.70	4164.33	4169.87	4170.21	4170.32	4169.65
Groundwater Quality Parameters										
Temperature (°C)	23.29	Not Measured			26.58	24.09	23.9	24.41	18.8	19.66
pH	6.9				7.27	7.05	6.75	6.87	7.34	7.14
Oxidation/Reduction Potential (mV)	1.29				135	109	-25	26	4	-20
Dissolved O ₂ (mg/L)	1.94				7.5	2.15	4.21	11.82	13.6	5.85
Total Dissolved Solids (g/L)	1.68				1.63	1.37	1.74	2.02	1.33	1.19
Conductivity (mS/cm)	2.62				2.56	2.14	2.72	NM	2.08	1.86
Salinity (ppt)	1.4				1.3	1.1	1.4	1.6	1.1	0.9

Supplemental Sampling Event:

	HD-MW01	HD-MW02	HD-MW03	HD-MW04	HD-MW05	HD-MW07	HD-GW08	HD-GW09	HD-GW10	HD-GW11	HD-GW12
Groundwater Relative Elevation Data											
Relative TOC Elevation (ft.)	4178.59	4178.58	4178.60	4178.65	4178.66	4172.49	4178.86	4178.88	4178.86	4178.93	4178.94
Depth to Water (ft. below TOC)	7.23	7.23	7.28	7.38	7.40	7.60	7.51	7.58	7.52	7.57	7.58
Relative Groundwater Elevation (ft.)	4171.36	4171.35	4171.32	4171.27	4171.26	4164.89	4171.35	4171.30	4171.34	4171.36	4171.36
Groundwater Quality Parameters											
Temperature (°C)	Not Measured										
pH											
Oxidation/Reduction Potential (mV)											
Dissolved O ₂ (mg/L)											
Total Dissolved Solids (g/L)											
Conductivity (mS/cm)											
Salinity (ppt)											
	HD-GW13	HD-GW14	HD-GW15	HD-GW16	HD-GW17	HD-GW18	HD-GW20	HD-GW21	HD-GW22	HD-GW23	HD-GW24
Groundwater Relative Elevation Data											
Relative TOC Elevation (ft.)	4178.86	4178.92	4178.96	4178.83	4179.19	4179.32	4178.82	4178.63	4178.15	4178.53	4178.49
Depth to Water (ft. below TOC)	7.44	7.51	7.59	7.50	7.88	7.99	7.84	10.00	10.00	10.70	7.50
Relative Groundwater Elevation (ft.)	4171.42	4171.41	4171.37	4171.33	4171.31	4171.33	4170.98	4168.63	4168.15	4167.83	4170.99
Groundwater Quality Parameters											
Temperature (°C)	Not Measured	14.23	Not Measured				13.84	11.4	9.34	Insufficient Water Volume	
pH		7.53					7.07	7.24	7.41		
Oxidation/Reduction Potential (mV)		162					163	-2	143		
Dissolved O ₂ (mg/L)		4.24					3.17	4.94	7.1		
Total Dissolved Solids (g/L)		1.54					1.36	1.64	0.855		
Conductivity (mS/cm)		2.41					2.12	2.55	1.45		
Salinity (ppt)		1.2					1.1	1.3	0.8		
	HD-GW25	HD-GW26	HD-GW33	HD-GW27	HD-GW28	HD-GW29	HD-GW30	HD-GW31	HD-GW32	HD-GW34	
Groundwater Relative Elevation Data											
Relative TOC Elevation (ft.)	4178.86	4178.86	4178.86	No Data	4177.85	4178.42	4179.20	4177.91	4177.91	4177.98	
Depth to Water (ft. below TOC)	7.60	7.60	7.60	8.60	7.40	7.52	7.60	9.00	7.80	7.50	
Relative Groundwater Elevation (ft.)	4171.26	4171.26	4171.26	No Data	4170.45	4170.90	4171.60	4168.91	4170.11	4170.48	
Groundwater Quality Parameters											
Temperature (°C)	12.25	12.76	6.69	13.75	11.81	10.95	11.1	8.23	8.69	14.82	
pH	7.94	7.85	8.42	6.72	7.20	7.44	7.30	7.45	7.36	7.15	
Oxidation/Reduction Potential (mV)	-38	74	54	202	2.21	1.9	173	-39	-27	-2	
Dissolved O ₂ (mg/L)	5.50	3.65	8.04	9.66	2.62	8.35	7.53	4.87	3.05	2.59	
Total Dissolved Solids (g/L)	2.01	1.41	1.31	2.18	1.33	1.38	2.63	2.83	2.94	2.73	
Conductivity (mS/cm)	3.14	2.20	2.05	3.42	2.08	2.16	9.00	9.92	4.60	4.27	
Salinity (ppt)	1.6	1.1	1.0	1.8	1.0	1.1	2.1	2.3	2.4	2.3	

Notes:

ft. - feet; °C - degrees Celsius; m - milli; V - volts; g - grams; L - liters; S - Siemens; cm - centimeter; ppt - parts per trillion
 Groundwater was not sampled at locations listed as "Not Measured." Well HD-MW06 was sealed and could not be opened.

Table C-4: Soil Samples Analytical Results Summary

Henrie's Dry Cleaners - Salt Lake City, UT

Phase II ESA Report

Page 1 of 4

CAS Number	Analyte Name	Units	EPA RSL Res.	EPA RSL Ind.	HD-BH01 (0.5-2.5')	HD-BH01 (5-7')	HD-BH02 (1.6-3.6')	HD-BH02 (6-8')	HD-BH03 (1-3')	HD-BH03 (6.5-8.5')	HD-BH04 (0.8-2.8')	HD-BH04 (5.5-8.0')	HD-BH05 (0.6-1.8')	HD-BH05 (5.6-8')	HD-BH05D (5.6-8')	HD-BH06 (7-9')	HD-BH06D (7-9')	HD-BH06 (11-14')	HD-SS-01	HD-SS-02	HD-BH07 (8.0-10.0')	
Percent Solids					74.3	79.8	66.5	71.6	69.1	70.8	69.5	70.7	86.3	69.8	74.4	73.2	71.3	81.5	67.1	98.6	72	
Volatile Organic Compounds																						
630-20-6	1,1,1,2-Tetrachloroethane	ug/Kg	2000	8800	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
71-55-6	1,1,1-Trichloroethane	ug/Kg	8100000	36000000	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
79-34-5	1,1,2,2-Tetrachloroethane	ug/Kg	600	2700	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
79-00-5	1,1,2-Trichloroethane	ug/Kg	1100	5000	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
75-34-3	1,1-Dichloroethane	ug/Kg	3600	16000	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
75-35-4	1,1-Dichloroethene	ug/Kg	230000	1000000	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
563-58-6	1,1-Dichloropropene	ug/Kg	--	--	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
87-61-6	1,2,3-Trichlorobenzene	ug/Kg	63000	930000	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
96-18-4	1,2,3-Trichloropropane	ug/Kg	5.1	110	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
120-82-1	1,2,4-Trichlorobenzene	ug/Kg	24000	110000	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
95-63-6	1,2,4-Trimethylbenzene	ug/Kg	58000	240000	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
96-12-8	1,2-Dibromo-3-Chloropropane	ug/Kg	5.3	64	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
106-93-4	1,2-Dibromoethane	ug/Kg	36	160	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
95-50-1	1,2-Dichlorobenzene	ug/Kg	1800000	9300000	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
107-06-2	1,2-Dichloroethane	ug/Kg	460	2000	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
78-87-5	1,2-Dichloropropane	ug/Kg	1000	4400	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
108-67-8	1,3,5-Trimethylbenzene	ug/Kg	780000	12000000	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
541-73-1	1,3-Dichlorobenzene	ug/Kg	--	--	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
142-28-9	1,3-Dichloropropane	ug/Kg	1600000	23000000	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
106-46-7	1,4-Dichlorobenzene	ug/Kg	2600	11000	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
544-10-5	1-Chlorohexane	ug/Kg	--	--	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
594-20-7	2,2-Dichloropropane	ug/Kg	--	--	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
95-49-8	2-Chlorotoluene	ug/Kg	1600000	23000000	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
591-78-6	2-Hexanone	ug/Kg	200000	1300000	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
106-43-4	4-Chlorotoluene	ug/Kg	1600000	23000000	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
67-64-1	Acetone	ug/Kg	61000000	670000000	2.2	U	1.9	U	2.3	U	2	U	2.2	U	2.4	U	1.9	U	2.2	U	2.3	U
107-05-1	Allyl chloride	ug/Kg	720	3200	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
71-43-2	Benzene	ug/Kg	200 ⁽¹⁾	5100	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
108-86-1	Bromobenzene	ug/Kg	290000	1800000	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
74-97-5	Bromochloromethane	ug/Kg	150000	630000	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
75-27-4	Bromodichloromethane	ug/Kg	290	1300	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
75-25-2	Bromoform	ug/Kg	19000	86000	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
74-83-9	Bromomethane	ug/Kg	6800	30000	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
75-15-0	Carbon disulfide	ug/Kg	770000	3500000	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
56-23-5	Carbon tetrachloride	ug/Kg	650	2900	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
108-90-7	Chlorobenzene	ug/Kg	280000	1300000	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
67-66-3	Chloroform	ug/Kg	320	1400	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
156-59-2	cis-1,2-Dichloroethene	ug/Kg	160000	2300000	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
10061-01-5	cis-1,3-Dichloropropene	ug/Kg	--	--	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
98-82-8	Cumene	ug/Kg	1900000	9900000	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
110-82-7	Cyclohexane	ug/Kg	6500000	27000000	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
124-48-1	Dibromochloromethane	ug/Kg	8300	39000	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
74-95-3	Dibromomethane	ug/Kg	24000	99000	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
75-71-8	Dichlorodifluoromethane	ug/Kg	87000	370000	2.0	U	1.8	U	2.1	U	1.9	U	2.0	U	2.3	U	1.8	U	2.0	U	2.1	U
75-43-4																						

CAS Number	Analyte Name	Units	EPA RSL Res.	EPA RSL Ind.	HD-BH01 (0.5-2.5')	HD-BH01 (5-7')	HD-BH02 (1.6-3.6')	HD-BH02 (6-8')	HD-BH03 (1-3')	HD-BH03 (6.5-8.5')	HD-BH04 (0.8-2.8')	HD-BH04 (5.5-8.0')	HD-BH05 (0.6-1.8')	HD-BH05 (5.6-8')	HD-BH05D (5.6-8')	HD-BH06 (7-9')	HD-BH06D (7-9')	HD-BH06 (11-14')	HD-SS-01	HD-SS-02	HD-BH07 (8.0-10.0')												
Petroleum Hydrocarbons																																	
GRO	Gasoline Range Organics	ug/Kg	150000 ⁽¹⁾		20	U	18	U	21	U	23	U	18	U	20	U	17	U	20	U	21	U	500000	16	U	23	U						
DRO	Diesel Range Organics	mg/Kg	500 ⁽¹⁾		8.9	U	8.2	U	10	U	9.2	U	9.5	U	9.3	U	770	U	9.5	U	8.8	U	9.0	U	9.3	U	8.2	U	21000	140		11	U
Semi Volatile Organic Compounds																																	
120-82-1	1,2,4-Trichlorobenzene	ug/Kg	24000	110000	67	U			75	U			71	U			57	U							3000	U	50	U	2.3	U			
95-50-1	1,2-Dichlorobenzene	ug/Kg	1800000	9300000	67	U			75	U			71	U			57	U							3000	U	50	U	2.3	U			
541-73-1	1,3-Dichlorobenzene	ug/Kg	--	--	67	U			75	U			71	U			57	U							3000	U	50	U	2.3	U			
106-46-7	1,4-Dichlorobenzene	ug/Kg	2600	11000	67	U			75	U			71	U			57	U							3000	U	50	U	2.3	U			
95-95-4	2,4,5-Trichlorophenol	ug/Kg	6300000	82000000	67	U			75	U			71	U			57	U							3000	U	50	U	69	U			
88-06-2	2,4,6-Trichlorophenol	ug/Kg	49000	210000	67	U			75	U			71	U			57	U							3000	U	50	U	69	U			
120-83-2	2,4-Dichlorophenol	ug/Kg	190000	2500000	67	U			75	U			71	U			57	U							3000	U	50	U	69	U			
105-67-9	2,4-Dimethylphenol	ug/Kg	1300000	16000000	76	U			85	U			81	U			65	U							3400	U	57	U	78	U			
51-28-5	2,4-Dinitrophenol	ug/Kg	130000	1600000	360	U			400	U			380	U			300	U							16000	U	270	U	370	U			
121-14-2	2,4-Dinitrotoluene	ug/Kg	1700	7400	67	U			75	U			71	U			57	U							3000	U	50	U	69	U			
606-20-2	2,6-Dinitrotoluene	ug/Kg	360	1500	67	U			75	U			71	U			57	U							3000	U	50	U	69	U			
91-58-7	2-Chloronaphthalene	ug/Kg	4800000	60000000	67	U			75	U			71	U			57	U							3000	U	50	U	69	U			
95-57-8	2-Chlorophenol	ug/Kg	390000	5800000	67	U			75	U			71	U			57	U							3000	U	50	U	69	U			
91-57-6	2-Methylnaphthalene	ug/Kg	240000	3000000	67	U			75	U			71	U			57	U							3000	U	50	U	69	U			
95-48-7	2-Methylphenol	ug/Kg	3200000	41000000	67	U			75	U			71	U			57	U							3000	U	50	U	69	U			
88-74-4	2-Nitroaniline	ug/Kg	630000	8000000	67	U			75	U			71	U			57	U							3000	U	50	U	69	U			
88-75-5	2-Nitrophenol	ug/Kg	--	--	67	U			75	U			71	U			57	U							3000	U	50	U	69	U			
91-94-1	3,3'-Dichlorobenzidine	ug/Kg	1200	5100	94	U			110	U			100	U			80	U							4200	U	70	U	97	U			
99-09-2	3-Nitroaniline	ug/Kg	--	--	67	U			75	U			71	U			57	U							3000	U	50	U	69	U			
534-52-1	4,6-Dinitro-2-methylphenol	ug/Kg	5100	66000	270	U			300	U			290	U			230	U							12000	U	200	U	280	U			
101-55-3	4-Bromophenyl phenyl ether	ug/Kg	--	--	67	U			75	U			71	U			57	U							3000	U	50	U	69	U			
59-50-7	4-Chloro-3-methylphenol	ug/Kg	6300000	82000000	67	U			75	U			71	U			57	U							3000	U	50	U	69	U			
106-47-8	4-Chloroaniline	ug/Kg	2700	11000	76	U			85	U			81	U			65	U							3400	U	57	U	78	U			
7005-72-3	4-Chlorophenyl phenyl ether	ug/Kg	--	--	67	U			75	U			71	U			57	U							3000	U	50	U	69	U			
106-44-5	4-Methylphenol	ug/Kg	6300000	82000000	67	U			75	U			71	U			57	U							3000	U	50	U	69	U			
100-01-6	4-Nitroaniline	ug/Kg	27000	110000	67	U			75	U			71	U			57	U							3000	U	50	U	69	U			
100-02-7	4-Nitrophenol	ug/Kg	--	--	270	U			300	U			290	U			230	U							12000	U	200	U	280	U			
83-32-9	Acenaphthene	ug/Kg	3600000	45000000	67	U			75	U			71	U			57	U							3000	U	50	U	69	U			
208-96-8	Acenaphthylene	ug/Kg	--	--	67	U			75	U			71	U			57	U							3000	U	50	U	69	U			
120-12-7	Anthracene	ug/Kg	18000000	230000000	67	U			75	U			71	U			57	U							3000	U	50	U	69	U			
56-55-3	Benzo(a)anthracene	ug/Kg	160	2900	67	U			75	U			71	U			70	J							3000	U	50	U	69	U			
50-32-8	Benzo(a)pyrene	ug/Kg	16	290	67	U			75	U			71	U			100	J							3000	U	50	U	69	U			
205-99-2	Benzo(b)fluoranthene	ug/Kg	160	2900	67	U			75	U			71	U			140	J							3000	U	50	U	69	U			
191-24-2	Benzo(g,h,i)perylene	ug/Kg	--	--	67	U			75	U			71	U			57	U							3000	U	50	U	69	U			
207-08-9	Benzo(k)fluoranthene	ug/Kg	1600	29000	67	U			75	U			71	U			57	U							3000	U	50	U	69	U			
65-85-0	Benzoic acid	ug/Kg	250000000	3300000000	270	U			300	U			290	U			230	U							12000	U	200	U	280	U			
100-51-6	Benzyl alcohol	ug/Kg	6300000	82000000	67	U			75	U			71	U			57	U							3000	U	50	U	69	U			
111-91-1	Bis(2-Chloroethoxy)methane	ug/Kg	190000	2500000	67	U			75	U			71	U			57	U							3000	U	50	U	69	U			
111-44-4	Bis(2-chloroethyl)ether	ug/Kg	230	1000	67	U			75	U			71	U			57	U							3000	U	50	U	69	U			
108-60-1	bis(2-Chloroisopropyl)ether	ug/Kg	3100000	47000000	67	U			75	U			71	U																			

Table C-4 : Soil Samples Analytical Results Summary

Henrie's Dry Cleaners - Salt Lake City, UT

Phase II ESA Report

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CAS Number	Analyte Name	Units	EPA RSL Res.	EPA RSL Ind.	HD-BH08 (8.0-10.0')	HD-BH09 (0.4-2.4')	HD-BH10 (8.0-12.0')	HD-BH11 (0.3-1.8')	HD-BH12 (8.0-10.8')	HD-BH13 (8.0-11.0')	HD-BH13D (8.0-11.0')	HD-BH14 (8.0-10.0')	HD-BH15 (0.3-2.8')	HD-BH16 (0.3-2.7')	HD-BH17 (8.0-11.1')	HD-BH17D (8.0-11.1')	HD-BH18 (8.0-10.0')	HD-BH19 (8.0-10.0')
Percent Solids					75.5	68.2	78.1	77.8	70.7	77.1	69.9	67.5	81.8	63.7	72.4	71.6	78.7	71.6
Volatile Organic Compounds																		
630-20-6	1,1,1,2-Tetrachloroethane	ug/Kg	2000	8800	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
71-55-6	1,1,1-Trichloroethane	ug/Kg	8100000	36000000	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
79-34-5	1,1,2,2-Tetrachloroethane	ug/Kg	600	2700	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
79-00-5	1,1,2-Trichloroethane	ug/Kg	1100	5000	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
75-34-3	1,1-Dichloroethane	ug/Kg	3600	16000	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
75-35-4	1,1-Dichloroethene	ug/Kg	2300000	10000000	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
563-58-6	1,1-Dichloropropene	ug/Kg	--	--	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
87-61-6	1,2,3-Trichlorobenzene	ug/Kg	63000	930000	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
96-18-4	1,2,3-Trichloropropane	ug/Kg	5.1	110	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
120-82-1	1,2,4-Trichlorobenzene	ug/Kg	24000	110000	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
95-63-6	1,2,4-Trimethylbenzene	ug/Kg	58000	240000	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
96-12-8	1,2-Dibromo-3-Chloropropane	ug/Kg	5.3	64	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
106-93-4	1,2-Dibromoethane	ug/Kg	36	160	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
95-50-1	1,2-Dichlorobenzene	ug/Kg	1800000	9300000	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
107-06-2	1,2-Dichloroethane	ug/Kg	460	2000	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
78-87-5	1,2-Dichloropropane	ug/Kg	1000	4400	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
108-67-8	1,3,5-Trimethylbenzene	ug/Kg	780000	12000000	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
541-73-1	1,3-Dichlorobenzene	ug/Kg	--	--	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
142-28-9	1,3-Dichloropropane	ug/Kg	1600000	23000000	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
106-46-7	1,4-Dichlorobenzene	ug/Kg	2600	11000	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
544-10-5	1-Chlorohexane	ug/Kg	--	--	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
594-20-7	2,2-Dichloropropane	ug/Kg	--	--	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
95-49-8	2-Chlorotoluene	ug/Kg	1600000	23000000	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
591-78-6	2-Hexanone	ug/Kg	200000	1300000	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
106-43-4	4-Chlorotoluene	ug/Kg	1600000	23000000	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
67-64-1	Acetone	ug/Kg	61000000	670000000	2.2	U	46	U	7.8	U	41	U	22	U	2.2	U	2.6	U
107-05-1	Allyl chloride	ug/Kg	720	3200	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
71-43-2	Benzene	ug/Kg	200 ⁽¹⁾	5100	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
108-86-1	Bromobenzene	ug/Kg	290000	1800000	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
74-97-5	Bromochloromethane	ug/Kg	150000	630000	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
75-27-4	Bromodichloromethane	ug/Kg	290	1300	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
75-25-2	Bromoform	ug/Kg	19000	86000	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
74-83-9	Bromomethane	ug/Kg	6800	30000	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
75-15-0	Carbon disulfide	ug/Kg	770000	3500000	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
56-23-5	Carbon tetrachloride	ug/Kg	650	2900	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
108-90-7	Chlorobenzene	ug/Kg	280000	1300000	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
67-66-3	Chloroform	ug/Kg	320	1400	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
156-59-2	cis-1,2-Dichloroethene	ug/Kg	160000	2300000	2	U	43	U	2	U	38	U	21	U	3.3	J	6	J
10061-01-5	cis-1,3-Dichloropropene	ug/Kg	--	--	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
98-82-8	Cumene	ug/Kg	1900000	9900000	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
110-82-7	Cyclohexane	ug/Kg	6500000	27000000	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
124-48-1	Dibromochloromethane	ug/Kg	8300	39000	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
74-95-3	Dibromomethane	ug/Kg	24000	99000	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
75-71-8	Dichlorodifluoromethane	ug/Kg	87000	370000	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
75-43-4	Dichlorofluoromethane	ug/Kg	--	--	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
60-29-7	Diethyl ether	ug/Kg	16000000	230000000	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
141-78-6	Ethyl acetate	ug/Kg	620000	2600000	2.2	U	46	U	2.1	U	41	U	22	U	2.2	U	2.6	U
100-41-4	Ethyl benzene	ug/Kg	5800	25000	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
75-00-3	Ethyl chloride	ug/Kg	14000000	57000000	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
97-63-2	Ethyl methacrylate	ug/Kg	1800000	7600000	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
75-69-4	Freon 11	ug/Kg	23000000	350000000	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
76-13-1	Freon 113	ug/Kg	40000000	170000000	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
87-68-3	Hexachloro-1,3-butadiene	ug/Kg	1200	5300	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
179601-23-1	m,p-Xylene	ug/Kg	142000 ⁽¹⁾	2400000	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U
79-20-9	Methyl Acetate	ug/Kg	78000000	1200000000	2	U	43	U	2	U	38	U	21					

CAS Number	Analyte Name	Units	EPA RSL Res.	EPA RSL Ind.	HD-BH08 (8.0-10.0')	HD-BH09 (0.4-2.4')	HD-BH10 (8.0-12.0')	HD-BH11 (0.3-1.8')	HD-BH12 (8.0-10.8')	HD-BH13 (8.0-11.0')	HD-BH13D (8.0-11.0')	HD-BH14 (8.0-10.0')	HD-BH15 (0.3-2.8')	HD-BH16 (0.3-2.7')	HD-BH17 (8.0-11.1')	HD-BH17D (8.0-11.1')	HD-BH18 (8.0-10.0')	HD-BH19 (8.0-10.0')														
Petroleum Hydrocarbons																																
GRO	Gasoline Range Organics	ug/Kg	150000 ⁽¹⁾		20	U	430	U	20	U	380	U	210	U	21	U	25	U	190	U	270	U	39	U	38	U	160	U	190	U		
DRO	Diesel Range Organics	mg/Kg	500 ⁽¹⁾		10	U	12	U	10	U	10	U	11	U	10	U	11	U	12	U	9.7	U	13	U	11	U	11	U	20	U	11	U
Semi Volatile Organic Compounds																																
120-82-1	1,2,4-Trichlorobenzene	ug/Kg	24000	110000	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U	2.2	U	18	U	27	U	3.9	U	3.8	U	16	U	19	U
95-50-1	1,2-Dichlorobenzene	ug/Kg	1800000	9300000	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U	2.2	U	18	U	27	U	3.9	U	3.8	U	16	U	19	U
541-73-1	1,3-Dichlorobenzene	ug/Kg	--	--	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U	2.2	U	18	U	27	U	3.9	U	3.8	U	16	U	19	U
106-46-7	1,4-Dichlorobenzene	ug/Kg	2600	11000	2	U	43	U	2	U	38	U	21	U	2.1	U	2.5	U	2.2	U	18	U	27	U	3.9	U	3.8	U	16	U	19	U
95-95-4	2,4,5-Trichlorophenol	ug/Kg	6300000	82000000	65	U	73	U	63	U	64	U	70	U	65	U	70	U	73	U	61	U	78	U	68	U	69	U	62	U	69	U
88-06-2	2,4,6-Trichlorophenol	ug/Kg	49000	210000	65	U	73	U	63	U	64	U	70	U	65	U	70	U	73	U	61	U	78	U	68	U	69	U	62	U	69	U
120-83-2	2,4-Dichlorophenol	ug/Kg	190000	2500000	65	U	73	U	63	U	64	U	70	U	65	U	70	U	73	U	61	U	78	U	68	U	69	U	62	U	69	U
105-67-9	2,4-Dimethylphenol	ug/Kg	1300000	16000000	74	U	83	U	71	U	73	U	79	U	73	U	80	U	83	U	69	U	88	U	77	U	78	U	71	U	78	U
51-28-5	2,4-Dinitrophenol	ug/Kg	130000	1600000	350	U	390	U	340	U	340	U	370	U	350	U	380	U	390	U	320	U	410	U	360	U	370	U	330	U	370	U
121-14-2	2,4-Dinitrotoluene	ug/Kg	1700	7400	65	U	73	U	63	U	64	U	70	U	65	U	70	U	73	U	61	U	78	U	68	U	69	U	62	U	69	U
606-20-2	2,6-Dinitrotoluene	ug/Kg	360	1500	65	U	73	U	63	U	64	U	70	U	65	U	70	U	73	U	61	U	78	U	68	U	69	U	62	U	69	U
91-58-7	2-Chloronaphthalene	ug/Kg	4800000	60000000	65	U	73	U	63	U	64	U	70	U	65	U	70	U	73	U	61	U	78	U	68	U	69	U	62	U	69	U
95-57-8	2-Chlorophenol	ug/Kg	390000	5800000	65	U	73	U	63	U	64	U	70	U	65	U	70	U	73	U	61	U	78	U	68	U	69	U	62	U	69	U
91-57-6	2-Methylnaphthalene	ug/Kg	240000	3000000	65	U	73	U	63	U	64	U	70	U	65	U	70	U	73	U	61	U	78	U	68	U	69	U	62	U	69	U
95-48-7	2-Methylphenol	ug/Kg	3200000	41000000	65	U	73	U	63	U	64	U	70	U	65	U	70	U	73	U	61	U	78	U	68	U	69	U	62	U	69	U
88-74-4	2-Nitroaniline	ug/Kg	630000	8000000	65	U	73	U	63	U	64	U	70	U	65	U	70	U	73	U	61	U	78	U	68	U	69	U	62	U	69	U
88-75-5	2-Nitrophenol	ug/Kg	--	--	65	U	73	U	63	U	64	U	70	U	65	U	70	U	73	U	61	U	78	U	68	U	69	U	62	U	69	U
91-94-1	3,3'-Dichlorobenzidine	ug/Kg	1200	5100	92	U	100	U	88	U	90	U	98	U	91	U	99	U	100	U	85	U	110	U	95	U	96	U	87	U	97	U
99-09-2	3-Nitroaniline	ug/Kg	--	--	65	U	73	U	63	U	64	U	70	U	65	U	70	U	73	U	61	U	78	U	68	U	69	U	62	U	69	U
534-52-1	4,6-Dinitro-2-methylphenol	ug/Kg	5100	66000	260	U	290	U	250	U	260	U	280	U	260	U	280	U	290	U	240	U	310	U	270	U	280	U	250	U	280	U
101-55-3	4-Bromophenyl phenyl ether	ug/Kg	--	--	65	U	73	U	63	U	64	U	70	U	65	U	70	U	73	U	61	U	78	U	68	U	69	U	62	U	69	U
59-50-7	4-Chloro-3-methylphenol	ug/Kg	6300000	82000000	65	U	73	U	63	U	64	U	70	U	65	U	70	U	73	U	61	U	78	U	68	U	69	U	62	U	69	U
106-47-8	4-Chloroaniline	ug/Kg	2700	11000	74	U	83	U	71	U	73	U	79	U	73	U	80	U	83	U	69	U	88	U	77	U	78	U	71	U	78	U
7005-72-3	4-Chlorophenyl phenyl ether	ug/Kg	--	--	65	U	73	U	63	U	64	U	70	U	65	U	70	U	73	U	61	U	78	U	68	U	69	U	62	U	69	U
106-44-5	4-Methylphenol	ug/Kg	6300000	82000000	65	U	73	U	63	U	64	U	70	U	65	U	70	U	73	U	61	U	78	U	68	U	69	U	62	U	69	U
100-01-6	4-Nitroaniline	ug/Kg	27000	110000	65	U	73	U	63	U	64	U	70	U	65	U	70	U	73	U	61	U	78	U	68	U	69	U	62	U	69	U
100-02-7	4-Nitrophenol	ug/Kg	--	--	260	U	290	U	250	U	260	U	280	U	260	U	280	U	290	U	240	U	310	U	270	U	280	U	250	U	280	U
83-32-9	Acenaphthene	ug/Kg	3600000	45000000	65	U	73	U	63	U	64	U	70	U	65	U	70	U	73	U	61	U	78	U	68	U	69	U	62	U	69	U
208-96-8	Acenaphthylene	ug/Kg	--	--	65	U	73	U	63	U	64	U	70	U	65	U	70	U	73	U	61	U	78	U	68	U	69	U	62	U	69	U
120-12-7	Anthracene	ug/Kg	18000000	230000000	65	U	73	U	63	U	64	U	70	U	65	U	70	U	73	U	61	U	78	U	68	U	69	U	62	U	69	U
56-55-3	Benzo(a)anthracene	ug/Kg	160	2900	65	U	73	U	63	U	64	U	70	U	65	U	70	U	73	U	61	U	78	U	68	U	69	U	62	U	69	U
50-32-8	Benzo(a)pyrene	ug/Kg	16	290	65	U	73	U	63	U	64	U	70	U	65	U	70	U	73	U	61	U	78	U	68	U	69	U	62	U	69	U
205-99-2	Benzo(b)fluoranthene	ug/Kg	160	2900	65	U	73	U	63	U	64	U	70	U	65	U	70	U	73	U	61	U	78	U</								

Table C-5 : Groundwater Samples Analytical Results Summary

Henrie's Dry Cleaners - Salt Lake City, UT

Phase II ESA Report

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CAS Number	Analyte Name	Units	EPA RSL Tap.	EPA MCL	HD-GW-01	HD-GW-02	HD-GW-02D	HD-GW-06	HD-MW-01	HD-MW-05	HD-MW-07	HD-GW14	HD-GW20	HD-GW21	HD-GW22	HD-GW23
Volatile Organic Compounds																
630-20-6	1,1,1,2-Tetrachloroethane	ug/L	0.57	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
71-55-6	1,1,1-Trichloroethane	ug/L	8000	200	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
79-34-5	1,1,2,2-Tetrachloroethane	ug/L	0.076	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
79-00-5	1,1,2-Trichloroethane	ug/L	0.28	5	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
75-34-3	1,1-Dichloroethane	ug/L	2.8	--	0.3 U	0.3 U	0.3 U	0.5 J	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
75-35-4	1,1-Dichloroethene	ug/L	280	7	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.5 J	13	0.3 U	1.5 U	0.45 J	0.3 U	0.3 U
563-58-6	1,1-Dichloropropene	ug/L	--	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
87-61-6	1,2,3-Trichlorobenzene	ug/L	7	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
96-18-4	1,2,3-Trichloropropane	ug/L	0.00075	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
120-82-1	1,2,4-Trichlorobenzene	ug/L	1.2	70	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
95-63-6	1,2,4-Trimethylbenzene	ug/L	15	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
96-12-8	1,2-Dibromo-3-Chloropropane	ug/L	0.00033	0.2	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
106-93-4	1,2-Dibromoethane	ug/L	0.0075	0.05	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
95-50-1	1,2-Dichlorobenzene	ug/L	300	600	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
107-06-2	1,2-Dichloroethane	ug/L	0.17	5	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
78-87-5	1,2-Dichloropropane	ug/L	0.44	5	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
108-67-8	1,3,5-Trimethylbenzene	ug/L	120	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
541-73-1	1,3-Dichlorobenzene	ug/L	--	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
142-28-9	1,3-Dichloropropane	ug/L	370	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
106-46-7	1,4-Dichlorobenzene	ug/L	0.48	75	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
544-10-5	1-Chlorohexane	ug/L	--	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
594-20-7	2,2-Dichloropropane	ug/L	--	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
95-49-8	2-Chlorotoluene	ug/L	240	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
591-78-6	2-Hexanone	ug/L	38	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	6.0 U	15 U	1.5 U	7.5 U	3.4 J	1.5 U	1.5 U
106-43-4	4-Chlorotoluene	ug/L	250	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
67-64-1	Acetone	ug/L	14000	--	1.5 U	1.8 J	1.5 U	1.5 U	1.5 U	6.0 U	15 U	1.5 U	7.5 U	21	1.5 U	4.7 J
107-05-1	Allyl chloride	ug/L	0.73	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
71-43-2	Benzene	ug/L	0.46	5	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.98 J	1.5 U	0.43 J	0.3 U	0.3 U
108-86-1	Bromobenzene	ug/L	62	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
74-97-5	Bromochloromethane	ug/L	83	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
75-27-4	Bromodichloromethane	ug/L	0.13	80	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
75-25-2	Bromoform	ug/L	3.3	80	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
74-83-9	Bromomethane	ug/L	7.5	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
75-15-0	Carbon disulfide	ug/L	810	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.39 J	0.3 U	0.3 U
56-23-5	Carbon tetrachloride	ug/L	0.46	5	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
108-90-7	Chlorobenzene	ug/L	78	100	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
67-66-3	Chloroform	ug/L	0.22	80	0.3 U	0.3 U	0.3 U	0.3 U	3.8	1.2 U	3.5 J	0.86 J	1.7 J	0.3 U	0.3 U	0.3 U
156-59-2	cis-1,2-Dichloroethene	ug/L	36	70	40	5.9	6.2	380	18	160	1600	29	89	120	0.3 U	150
10061-01-5	cis-1,3-Dichloropropene	ug/L	--	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
98-82-8	Cumene	ug/L	450	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
110-82-7	Cyclohexane	ug/L	13000	--	0.3 U	0.3 U	0.3 U	4.2	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
124-48-1	Dibromochloromethane	ug/L	0.87	80	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
74-95-3	Dibromomethane	ug/L	8.3	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
75-71-8	Dichlorodifluoromethane	ug/L	200	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
75-43-4	Dichlorofluoromethane	ug/L	--	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
60-29-7	Diethyl ether	ug/L	3900	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
141-78-6	Ethyl acetate	ug/L	140	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	6.0 U	15 U	1.5 U	7.5 U	1.5 U	1.5 U	1.5 U
100-41-4	Ethyl benzene	ug/L	1.5	700	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
75-00-3	Ethyl chloride	ug/L	21000	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
97-63-2	Ethyl methacrylate	ug/L	630	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U

Notes: EPA - U.S. Environmental Protection Agency
Tap. - Tapwater (Target Hazard Quotient = 1.0 [May 2016])
ug/L - micrograms per liter
U = Qualifier indicates that the analyte was not detected above the Method Detection Limit.
BOLD - Analyte detected in sample

RSL - Regional Screening Level
MCL - Maximum Contaminant Level (Target Hazard Quotient = 1.0 [May 2016])
(1) - Utah Department of Environmental Quality Initial Screening Level used in place of RSL.
J = Qualifier Indicates that the analyte value is between the Method Detection Limit and the Reporting Limit.

Method Detection Limit exceeds Tap. RSL (analyte not detected).
Reported concentration of analyte exceeds Tap. RSL.
Method Detection Limit exceeds MCL/UDEQ ISL (analyte not detected).
Reported concentration of analyte exceeds MCL.

Table C-5 : Groundwater Samples Analytical Results Summary

Henrie's Dry Cleaners - Salt Lake City, UT

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CAS Number	Analyte Name	Units	EPA RSL Tap.	EPA MCL	HD-GW-01	HD-GW-02	HD-GW-02D	HD-GW-06	HD-MW-01	HD-MW-05	HD-MW-07	HD-GW14	HD-GW20	HD-GW21	HD-GW22	HD-GW23
75-69-4	Freon 11	ug/L	5200	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
76-13-1	Freon 113	ug/L	55000	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
87-68-3	Hexachloro-1,3-butadiene	ug/L	0.14	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
179601-23-1	m,p-Xylene	ug/L	--	10000	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
79-20-9	Methyl Acetate	ug/L	20000	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
74-87-3	Methyl chloride	ug/L	190	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
78-93-3	Methyl ethyl ketone	ug/L	5600	--	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	6.4 U	16 U	1.6 U	8 U	4.4 J	1.6 U	1.6 U
74-88-4	Methyl iodide	ug/L	--	--	0.42 U	0.42 U	0.42 U	0.42 U	0.42 U	1.7 U	4.2 U	0.42 U	2.1 U	0.42 U	0.42 U	0.42 U
108-10-1	Methyl isobutyl ketone	ug/L	6300	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	6.0 U	15 U	1.5 U	7.5 U	1.5 U	1.5 U	1.5 U
1634-04-4	Methyl t-butyl ether	ug/L	14	200 ⁽¹⁾	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
108-87-2	Methylcyclohexane	ug/L	--	--	0.3 U	0.3 U	0.3 U	3.0	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
75-09-2	Methylene chloride	ug/L	11	5	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
91-20-3	Naphthalene	ug/L	0.17	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
104-51-8	n-Butylbenzene	ug/L	1000	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
103-65-1	n-Propylbenzene	ug/L	660	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
95-47-6	o-Xylene	ug/L	190	10000	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
76-01-7	Pentachloroethane	ug/L	0.65	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
99-87-6	p-Isopropyltoluene	ug/L	--	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
135-98-8	sec-Butylbenzene	ug/L	2000	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
100-42-5	Styrene	ug/L	1200	100	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
98-06-6	tert-Butylbenzene	ug/L	690	--	0.3 U	0.3 U	0.3 U	0.48 J	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
127-18-4	Tetrachloroethene	ug/L	11	5	0.3 U	0.8 J	2.0	1.9	300	1600	4600	59	2100	4.6	0.3 U	0.3 U
109-99-9	Tetrahydrofuran	ug/L	3400	--	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	7.2 U	18 U	1.8 U	9 U	1.8 U	1.8 U	1.8 U
108-88-3	Toluene	ug/L	1100	1000	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.81 J	1.5 U	0.46 J	0.3 U	0.3 U
156-60-5	trans-1,2-Dichloroethene	ug/L	360	100	0.69 J	0.3 U	0.3 U	280	0.44 J	1.6 J	58	0.85 J	6.9	0.94 J	0.3 U	1.3
10061-02-6	trans-1,3-Dichloropropene	ug/L	--	--	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.3 U	0.3 U	0.3 U
110-57-6	trans-1,4-Dichloro-2-butene	ug/L	0.0013	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	6 U	15 U	1.5 U	7.5 U	1.5 U	1.5 U	1.5 U
79-01-6	Trichloroethene	ug/L	0.49	5	0.3 U	0.56 J	1.0	0.52 J	20	840	2000	6.6	330	1.7	0.3 U	13
75-01-4	Vinyl chloride	ug/L	0.019	2	0.3 U	0.3 U	0.3 U	430	0.3 U	1.2 U	3.0 U	0.3 U	1.5 U	0.32 J	0.3 U	0.45 J
Petroleum Hydrocarbons													Not Analyzed			
	Gasoline Range Organics	ug/L	1000 ⁽¹⁾		15 U	15 U	15 U	73	15 U	60 U	150 U					
	Diesel Range Organics	ug/L	1000 ⁽¹⁾		200 U	200 U	200 U	200 U	200 U	200 U	200 U					
Semi Volatile Organic Compounds																
120-82-1	1,2,4-Trichlorobenzene	ug/L	1.2	70	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	Not Analyzed				
95-50-1	1,2-Dichlorobenzene	ug/L	300	600	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
541-73-1	1,3-Dichlorobenzene	ug/L	--	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
106-46-7	1,4-Dichlorobenzene	ug/L	0.48	75	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
95-95-4	2,4,5-Trichlorophenol	ug/L	1200	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
88-06-2	2,4,6-Trichlorophenol	ug/L	4.1	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
120-83-2	2,4-Dichlorophenol	ug/L	46	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
105-67-9	2,4-Dimethylphenol	ug/L	360	--	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U					
51-28-5	2,4-Dinitrophenol	ug/L	39	--	15 U	15 U	15 U	15 U	15 U	15 U	15 U					
121-14-2	2,4-Dinitrotoluene	ug/L	0.24	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
606-20-2	2,6-Dinitrotoluene	ug/L	0.049	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
91-58-7	2-Chloronaphthalene	ug/L	750	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
95-57-8	2-Chlorophenol	ug/L	91	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
91-57-6	2-Methylnaphthalene	ug/L	36	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
95-48-7	2-Methylphenol	ug/L	930	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
88-74-4	2-Nitroaniline	ug/L	190	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
88-75-5	2-Nitrophenol	ug/L	--	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
91-94-1	3,3'-Dichlorobenzidine	ug/L	0.13	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					

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ug/L - micrograms per liter
U = Qualifier indicates that the analyte was not detected above the Method Detection Limit.
BOLD - Analyte detected in sample

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Method Detection Limit exceeds Tap. RSL (analyte not detected).
Reported concentration of analyte exceeds Tap. RSL.
Method Detection Limit exceeds MCL/UDEQ ISL (analyte not detected).
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Table C-5 : Groundwater Samples Analytical Results Summary

Henrie's Dry Cleaners - Salt Lake City, UT

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CAS Number	Analyte Name	Units	EPA RSL Tap.	EPA MCL	HD-GW-01	HD-GW-02	HD-GW-02D	HD-GW-06	HD-MW-01	HD-MW-05	HD-MW-07	HD-GW14	HD-GW20	HD-GW21	HD-GW22	HD-GW23
99-09-2	3-Nitroaniline	ug/L	--	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
534-52-1	4,6-Dinitro-2-methylphenol	ug/L	1.5	--	18 U	18 U	18 U	18 U	18 U	18 U	18 U					
101-55-3	4-Bromophenyl phenyl ether	ug/L	--	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
59-50-7	4-Chloro-3-methylphenol	ug/L	1400	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
106-47-8	4-Chloroaniline	ug/L	0.37	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
7005-72-3	4-Chlorophenyl phenyl ether	ug/L	--	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
106-44-5	4-Methylphenol	ug/L	1900	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
100-01-6	4-Nitroaniline	ug/L	3.8	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
100-02-7	4-Nitrophenol	ug/L	--	--	19 U	19 U	19 U	19 U	19 U	19 U	19 U					
83-32-9	Acenaphthene	ug/L	530	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
208-96-8	Acenaphthylene	ug/L	--	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
120-12-7	Anthracene	ug/L	1800	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
56-55-3	Benzo(a)anthracene	ug/L	0.012	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
50-32-8	Benzo(a)pyrene	ug/L	0.0034	0.2	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
205-99-2	Benzo(b)fluoranthene	ug/L	0.034	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
191-24-2	Benzo(g,h,i)perylene	ug/L	--	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
207-08-9	Benzo(k)fluoranthene	ug/L	0.34	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
65-85-0	Benzoic acid	ug/L	75000	--	15 U	15 U	15 U	15 U	15 U	15 U	15 U					
100-51-6	Benzyl alcohol	ug/L	2000	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
111-91-1	Bis(2-Chloroethoxy)methane	ug/L	59	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
111-44-4	Bis(2-chloroethyl)ether	ug/L	0.014	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
108-60-1	bis(2-Chloroisopropyl)ether	ug/L	710	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
117-81-7	Bis(2-ethylhexyl)phthalate	ug/L	5.6	6	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
85-68-7	Butylbenzylphthalate	ug/L	16	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
86-74-8	Carbazole	ug/L	--	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
218-01-9	Chrysene	ug/L	3.4	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
53-70-3	Dibenzo(a,h)anthracene	ug/L	0.0034	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
132-64-9	Dibenzofuran	ug/L	7.9	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
84-66-2	Diethylphthalate	ug/L	15000	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
131-11-3	Dimethylphthalate	ug/L	--	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
84-74-2	Di-n-butylphthalate	ug/L	900	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
117-84-0	Di-n-octylphthalate	ug/L	200	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
206-44-0	Fluoranthene	ug/L	800	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
86-73-7	Fluorene	ug/L	290	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
87-68-3	Hexachloro-1,3-butadiene	ug/L	0.14	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
118-74-1	Hexachlorobenzene	ug/L	0.0098	1	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
77-47-4	Hexachlorocyclopentadiene	ug/L	0.41	50	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
67-72-1	Hexachloroethane	ug/L	0.33	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
193-39-5	Indeno(1,2,3-cd)pyrene	ug/L	0.034	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
78-59-1	Isophorone	ug/L	78	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
91-20-3	Naphthalene	ug/L	0.17	700 ⁽¹⁾	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
98-95-3	Nitrobenzene	ug/L	0.14	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
621-64-7	N-Nitrosodi-n-propyl amine	ug/L	0.011	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
86-30-6	N-Nitrosodiphenylamine	ug/L	12	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
87-86-5	Pentachlorophenol	ug/L	0.041	1	18 U	18 U	18 U	18 U	18 U	18 U	18 U					
85-01-8	Phenanthrene	ug/L	--	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
108-95-2	Phenol	ug/L	5800	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
129-00-0	Pyrene	ug/L	120	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					
110-86-1	Pyridine	ug/L	20	--	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U					

Notes:

EPA - U.S. Environmental Protection Agency

Tap. - Tapwater (Target Hazard Quotient = 1.0 [May 2016])

ug/L - micrograms per liter

U = Qualifier indicates that the analyte was not detected above the Method Detection Limit.

BOLD - Analyte detected in sample

RSL - Regional Screening Level

MCL - Maximum Contaminant Level (Target Hazard Quotient = 1.0 [May 2016])

(1) - Utah Department of Environmental Quality Initial Screening Level used in place of RSL.

J = Qualifier Indicates that the analyte value is between the Method Detection Limit and the Reporting Limit.

Method Detection Limit exceeds Tap. RSL (analyte not detected).

Reported concentration of analyte exceeds Tap. RSL.

Method Detection Limit exceeds MCL/UDEQ ISL (analyte not detected).

Reported concentration of analyte exceeds MCL.

Table C-5 : Groundwater Samples Analytical Results Summary

Henrie's Dry Cleaners - Salt Lake City, UT

Phase II ESA Report

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CAS Number	Analyte Name	Units	EPA RSL Tap.	EPA MCL	HD-GW24	HD-GW25	HD-GW25D	HD-GW26	HD-GW27	HD-GW27D	HD-GW28	HD-GW29	HD-GW30	HD-GW31	HD-GW32	HD-GW33	HD-GW34
Volatile Organic Compounds																	
630-20-6	1,1,1,2-Tetrachloroethane	ug/L	0.57	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
71-55-6	1,1,1-Trichloroethane	ug/L	8000	200	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
79-34-5	1,1,2,2-Tetrachloroethane	ug/L	0.076	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
79-00-5	1,1,2-Trichloroethane	ug/L	0.28	5	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
75-34-3	1,1-Dichloroethane	ug/L	2.8	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
75-35-4	1,1-Dichloroethene	ug/L	280	7	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.6 J	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
563-58-6	1,1-Dichloropropene	ug/L	--	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
87-61-6	1,2,3-Trichlorobenzene	ug/L	7	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
96-18-4	1,2,3-Trichloropropane	ug/L	0.00075	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
120-82-1	1,2,4-Trichlorobenzene	ug/L	1.2	70	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
95-63-6	1,2,4-Trimethylbenzene	ug/L	15	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
96-12-8	1,2-Dibromo-3-Chloropropane	ug/L	0.00033	0.2	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
106-93-4	1,2-Dibromoethane	ug/L	0.0075	0.05	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
95-50-1	1,2-Dichlorobenzene	ug/L	300	600	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
107-06-2	1,2-Dichloroethane	ug/L	0.17	5	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
78-87-5	1,2-Dichloropropane	ug/L	0.44	5	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
108-67-8	1,3,5-Trimethylbenzene	ug/L	120	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
541-73-1	1,3-Dichlorobenzene	ug/L	--	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
142-28-9	1,3-Dichloropropane	ug/L	370	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
106-46-7	1,4-Dichlorobenzene	ug/L	0.48	75	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
544-10-5	1-Chlorohexane	ug/L	--	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
594-20-7	2,2-Dichloropropane	ug/L	--	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
95-49-8	2-Chlorotoluene	ug/L	240	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
591-78-6	2-Hexanone	ug/L	38	--	1.5 U	38 U	38 U	7.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U
106-43-4	4-Chlorotoluene	ug/L	250	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
67-64-1	Acetone	ug/L	14000	--	4.7 J	38 U	38 U	7.5 U	1.5 U	1.5 U	4 J	3.4 J	1.5 U	1.5 U	1.5 U	7.4	1.5 U
107-05-1	Allyl chloride	ug/L	0.73	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
71-43-2	Benzene	ug/L	0.46	5	0.76 J	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
108-86-1	Bromobenzene	ug/L	62	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
74-97-5	Bromochloromethane	ug/L	83	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
75-27-4	Bromodichloromethane	ug/L	0.13	80	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
75-25-2	Bromoform	ug/L	3.3	80	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
74-83-9	Bromomethane	ug/L	7.5	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
75-15-0	Carbon disulfide	ug/L	810	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
56-23-5	Carbon tetrachloride	ug/L	0.46	5	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
108-90-7	Chlorobenzene	ug/L	78	100	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
67-66-3	Chloroform	ug/L	0.22	80	0.3 U	7.5 U	7.5 U	2.7 J	0.3 U	0.3 U	1.1	0.63 J	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
156-59-2	cis-1,2-Dichloroethene	ug/L	36	70	46	720	730	32	260	260	270	99	1.7	0.3 U	0.3 U	0.3 U	260
10061-01-5	cis-1,3-Dichloropropene	ug/L	--	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
98-82-8	Cumene	ug/L	450	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
110-82-7	Cyclohexane	ug/L	13000	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
124-48-1	Dibromochloromethane	ug/L	0.87	80	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
74-95-3	Dibromomethane	ug/L	8.3	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
75-71-8	Dichlorodifluoromethane	ug/L	200	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
75-43-4	Dichlorofluoromethane	ug/L	--	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
60-29-7	Diethyl ether	ug/L	3900	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
141-78-6	Ethyl acetate	ug/L	140	--	1.5 U	38 U	38 U	7.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U
100-41-4	Ethyl benzene	ug/L	1.5	700	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
95-00-3	Ethyl chloride	ug/L	21000	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
97-63-2	Ethyl methacrylate	ug/L	630	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U

Notes: EPA - U.S. Environmental Protection Agency
Tap. - Tapwater (Target Hazard Quotient = 1.0 [May 2016])
ug/L - micrograms per liter
U = Qualifier indicates that the analyte was not detected above the Method Detection Limit.
BOLD - Analyte detected in sample

RSL - Regional Screening Level
MCL - Maximum Contaminant Level (Target Hazard Quotient = 1.0 [May 2016])
(1) - Utah Department of Environmental Quality Initial Screening Level used in place of RSL.
J = Qualifier Indicates that the analyte value is between the Method Detection Limit and the Reporting Limit.

Method Detection Limit exceeds Tap. RSL (analyte not detected).
Reported concentration of analyte exceeds Tap. RSL.
Method Detection Limit exceeds MCL/UDEQ ISL (analyte not detected).
Reported concentration of analyte exceeds MCL.

Table C-5 : Groundwater Samples Analytical Results Summary

Henrie's Dry Cleaners - Salt Lake City, UT

Phase II ESA Report

CAS Number	Analyte Name	Units	EPA RSL Tap.	EPA MCL	HD-GW24	HD-GW25	HD-GW25D	HD-GW26	HD-GW27	HD-GW27D	HD-GW28	HD-GW29	HD-GW30	HD-GW31	HD-GW32	HD-GW33	HD-GW34
75-69-4	Freon 11	ug/L	5200	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
76-13-1	Freon 113	ug/L	55000	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
87-68-3	Hexachloro-1,3-butadiene	ug/L	0.14	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
179601-23-1	m,p-Xylene	ug/L	--	10000	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
79-20-9	Methyl Acetate	ug/L	20000	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
74-87-3	Methyl chloride	ug/L	190	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
78-93-3	Methyl ethyl ketone	ug/L	5600	--	1.6 U	40 U	40 U	8 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U
74-88-4	Methyl iodide	ug/L	--	--	0.42 U	11 U	11 U	2.1 U	0.42 U	0.42 U	0.42 U	0.42 U	0.42 U	0.42 U	0.42 U	0.42 U	0.42 U
108-10-1	Methyl isobutyl ketone	ug/L	6300	--	1.5 U	38 U	38 U	7.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U
1634-04-4	Methyl t-butyl ether	ug/L	14	200 ⁽¹⁾	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
108-87-2	Methylcyclohexane	ug/L	--	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
75-09-2	Methylene chloride	ug/L	11	5	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
91-20-3	Naphthalene	ug/L	0.17	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
104-51-8	n-Butylbenzene	ug/L	1000	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
103-65-1	n-Propylbenzene	ug/L	660	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
95-47-6	o-Xylene	ug/L	190	10000	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
76-01-7	Pentachloroethane	ug/L	0.65	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
99-87-6	p-Isopropyltoluene	ug/L	--	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
135-98-8	sec-Butylbenzene	ug/L	2000	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
100-42-5	Styrene	ug/L	1200	100	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
98-06-6	tert-Butylbenzene	ug/L	690	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
127-18-4	Tetrachloroethene	ug/L	11	5	41	2400	2500	2500	3.3	3.2	440	41	7.2	0.3 U	0.3 U	48	9.5
109-99-9	Tetrahydrofuran	ug/L	3400	--	1.8 U	45 U	45 U	9 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U
108-88-3	Toluene	ug/L	1100	1000	0.85 J	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
156-60-5	trans-1,2-Dichloroethene	ug/L	360	100	1.8	7.5 U	7.5 U	1.5 U	5.9	5.8	6.5	7	0.3 U	0.3 U	0.3 U	0.3 U	4.8
10061-02-6	trans-1,3-Dichloropropene	ug/L	--	--	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
110-57-6	trans-1,4-Dichloro-2-butene	ug/L	0.0013	--	1.5 U	38 U	38 U	7.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U
79-01-6	Trichloroethene	ug/L	0.49	5	77	9100	8300	84	1.5	1.5	120	4.6	1.7	0.3 U	0.3 U	0.55 J	0.49 J
75-01-4	Vinyl chloride	ug/L	0.019	2	0.3 U	7.5 U	7.5 U	1.5 U	0.3 U	0.3 U	2.7	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.36 J
Petroleum Hydrocarbons					Not Analyzed												
	Gasoline Range Organics	ug/L	1000 ⁽¹⁾														
	Diesel Range Organics	ug/L	1000 ⁽¹⁾														
Semi Volatile Organic Compounds																	
120-82-1	1,2,4-Trichlorobenzene	ug/L	1.2	70													
95-50-1	1,2-Dichlorobenzene	ug/L	300	600													
541-73-1	1,3-Dichlorobenzene	ug/L	--	--													
106-46-7	1,4-Dichlorobenzene	ug/L	0.48	75													
95-95-4	2,4,5-Trichlorophenol	ug/L	1200	--													
88-06-2	2,4,6-Trichlorophenol	ug/L	4.1	--													
120-83-2	2,4-Dichlorophenol	ug/L	46	--													
105-67-9	2,4-Dimethylphenol	ug/L	360	--													
51-28-5	2,4-Dinitrophenol	ug/L	39	--													
121-14-2	2,4-Dinitrotoluene	ug/L	0.24	--													
606-20-2	2,6-Dinitrotoluene	ug/L	0.049	--													
91-58-7	2-Chloronaphthalene	ug/L	750	--													
95-57-8	2-Chlorophenol	ug/L	91	--													
91-57-6	2-Methylnaphthalene	ug/L	36	--													
95-48-7	2-Methylphenol	ug/L	930	--													
88-74-4	2-Nitroaniline	ug/L	190	--													
88-75-5	2-Nitrophenol	ug/L	--	--													
91-94-1	3,3'-Dichlorobenzidine	ug/L	0.13	--													

Notes: EPA - U.S. Environmental Protection Agency
Tap. - Tapwater (Target Hazard Quotient = 1.0 [May 2016])
ug/L - micrograms per liter
U = Qualifier indicates that the analyte was not detected above the Method Detection Limit.
BOLD - Analyte detected in sample

RSL - Regional Screening Level
MCL - Maximum Contaminant Level (Target Hazard Quotient = 1.0 [May 2016])
(1) - Utah Department of Environmental Quality Initial Screening Level used in place of RSL.
J = Qualifier Indicates that the analyte value is between the Method Detection Limit and the Reporting Limit.

Method Detection Limit exceeds Tap. RSL (analyte not detected).
Reported concentration of analyte exceeds Tap. RSL.
Method Detection Limit exceeds MCL/UDEQ ISL (analyte not detected).
Reported concentration of analyte exceeds MCL.

Table C-6 : Soil Gas Samples Analytical Results Summary

Henrie's Dry Cleaners - Salt Lake City, UT

Phase II ESA Report

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CAS Number	Analyte Name	OSWER VISL	Units	HD-SG01		HD-SG02	
71-55-6	1,1,1-Trichloroethane	170000	ug/m ³	0.82	U	0.82	U
79-34-5	1,1,2,2-Tetrachloroethane	1.6	ug/m ³	1.0	U	1.0	U
79-00-5	1,1,2-Trichloroethane	5.8	ug/m ³	0.82	U	0.82	U
75-34-3	1,1-Dichloroethane	58	ug/m ³	0.61	U	0.61	U
75-35-4	1,1-Dichloroethene	7000	ug/m ³	2.6		0.59	U
120-82-1	1,2,4-Trichlorobenzene	70	ug/m ³	2.2	U	2.2	U
95-63-6	1,2,4-Trimethylbenzene	240	ug/m ³	13		1.9	J
106-93-4	1,2-Dibromoethane	0.16	ug/m ³	1.2	U	1.2	U
95-50-1	1,2-Dichlorobenzene	7000	ug/m ³	1.8	U	1.8	U
107-06-2	1,2-Dichloroethane	3.6	ug/m ³	0.61	U	0.61	U
78-87-5	1,2-Dichloropropane	9.4	ug/m ³	0.73	U	0.73	U
108-67-8	1,3,5-Trimethylbenzene	--	ug/m ³	2.8		0.74	U
106-99-0	1,3-Butadiene	1.3	ug/m ³	0.33	U	0.33	U
541-73-1	1,3-Dichlorobenzene	--	ug/m ³	0.9	U	0.9	U
106-46-7	1,4-Dichlorobenzene	8.5	ug/m ³	0.9	U	0.9	U
591-78-6	2-Hexanone	1000	ug/m ³	120		1.2	U
622-96-8	4-Ethyl toluene	--	ug/m ³	2.2	J	0.74	U
67-64-1	Acetone	1100000	ug/m ³	490	E	960	E
71-43-2	Benzene	12	ug/m ³	21		2.0	
100-44-7	Benzyl chloride	1.9	ug/m ³	4.6	J	1.6	U
75-27-4	Bromodichloromethane	2.5	ug/m ³	1.0	U	1.0	U
75-25-2	Bromoform	85	ug/m ³	1.6	U	1.6	U
74-83-9	Bromomethane	170	ug/m ³	0.58	U	0.58	U
75-15-0	Carbon disulfide	24000	ug/m ³	21		2.8	
56-23-5	Carbon tetrachloride	16	ug/m ³	0.94	U	0.94	U
108-90-7	Chlorobenzene	1700	ug/m ³	0.69	U	0.69	U
67-66-3	Chloroform	4.1	ug/m ³	39		2.2	J
156-59-2	cis-1,2-Dichloroethene	--	ug/m ³	1600	E	1.1	J
10061-01-5	cis-1,3-Dichloropropene	23	ug/m ³	0.68	U	0.68	U
110-82-7	Cyclohexane	210000	ug/m ³	110		0.88	J
124-48-1	Dibromochloromethane	--	ug/m ³	1.3	U	1.3	U
75-71-8	Dichlorodifluoromethane	3500	ug/m ³	2.3	J	1.5	J
141-78-6	Ethyl acetate	2400	ug/m ³	0.54	U	2.9	J
100-41-4	Ethyl benzene	37	ug/m ³	3.6		0.88	J

Notes: OSWER - U.S. Environmental Protection Agency Office of Solid Waste and Emergency Response
VISL - Vapor Intrusion Screening Level [Target Sub-Slab and Exterior Soil Gas Concentration Target Health Quotient = 1.0 (July 2016)]

ug/m³ - micrograms per cubic meter

U = Qualifier indicates that the analyte was not detected above the Method Detection Limit.

J = Qualifier Indicates that the analyte value is between the Method Detection Limit and the Reporting Limit.

E = Qualifier Indicates that the analyte value is above the instrument calibration level.

BOLD - Analyte detected in sample

Method Detection Limit exceeds Tap. RSL (analyte not detected).

Reported concentration of analyte exceeds Tap. RSL.

Table C-6 : Soil Gas Samples Analytical Results Summary

Henrie's Dry Cleaners - Salt Lake City, UT

Phase II ESA Report

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CAS Number	Analyte Name	OSWER VISL	Units	HD-SG01		HD-SG02	
75-00-3	Ethyl chloride	350000	ug/m ³	0.4	U	0.4	U
75-69-4	Freon 11	--	ug/m ³	2.2	J	1.3	J
76-13-1	Freon 113	1000000	ug/m ³	1.3	J	1.1	U
76-14-2	Freon 114	--	ug/m ³	1.0	U	1.0	U
142-82-5	Heptane	--	ug/m ³	20		1.8	J
87-68-3	Hexachloro-1,3-butadiene	4.3	ug/m ³	3.2	U	3.2	U
179601-23-1	m,p-Xylene	3500	ug/m ³	9.2		2.2	
74-87-3	Methyl chloride	3100	ug/m ³	0.89	J	0.56	J
78-93-3	Methyl ethyl ketone	170000	ug/m ³	210		87	
108-10-1	Methyl isobutyl ketone	100000	ug/m ³	540		36	
1634-04-4	Methyl t-butyl ether	360	ug/m ³	0.54	U	0.54	U
75-09-2	Methylene chloride	3400	ug/m ³	14		6.8	
110-54-3	n-Hexane	24000	ug/m ³	20		2.2	
95-47-6	o-Xylene	3500	ug/m ³	4.2		0.66	J
100-42-5	Styrene	35000	ug/m ³	0.64	U	0.64	U
127-18-4	Tetrachloroethene	360	ug/m ³	2300	E	4000	E
109-99-9	Tetrahydrofuran	70000	ug/m ³	9.0		3.2	
108-88-3	Toluene	170000	ug/m ³	23		5.1	
156-60-5	trans-1,2-Dichloroethene	--	ug/m ³	2100	E	0.59	U
10061-02-6	trans-1,3-Dichloropropene	23	ug/m ³	0.68	U	0.68	U
79-01-6	Trichloroethene	16	ug/m ³	94		46	
108-05-4	Vinyl acetate	7000	ug/m ³	0.53	U	0.53	U
75-01-4	Vinyl chloride	5.6	ug/m ³	4000	E	0.81	J

Notes:

OSWER - U.S. Environmental Protection Agency Office of Solid Waste and Emergency Response

VISL - Vapor Intrusion Screening Level [Target Sub-Slab and Exterior Soil Gas Concentration Target Health Quotient = 1.0 (July 2016)]

ug/m³ - micrograms per cubic meter

U = Qualifier indicates that the analyte was not detected above the Method Detection Limit.

J = Qualifier Indicates that the analyte value is between the Method Detection Limit and the Reporting Limit.

E = Qualifier Indicates that the analyte value is above the instrument calibration level.

BOLD - Analyte detected in sample

Method Detection Limit exceeds Tap. RSL (analyte not detected).

Reported concentration of analyte exceeds Tap. RSL.

Figures and Tables Extracted from AECOM, 2018

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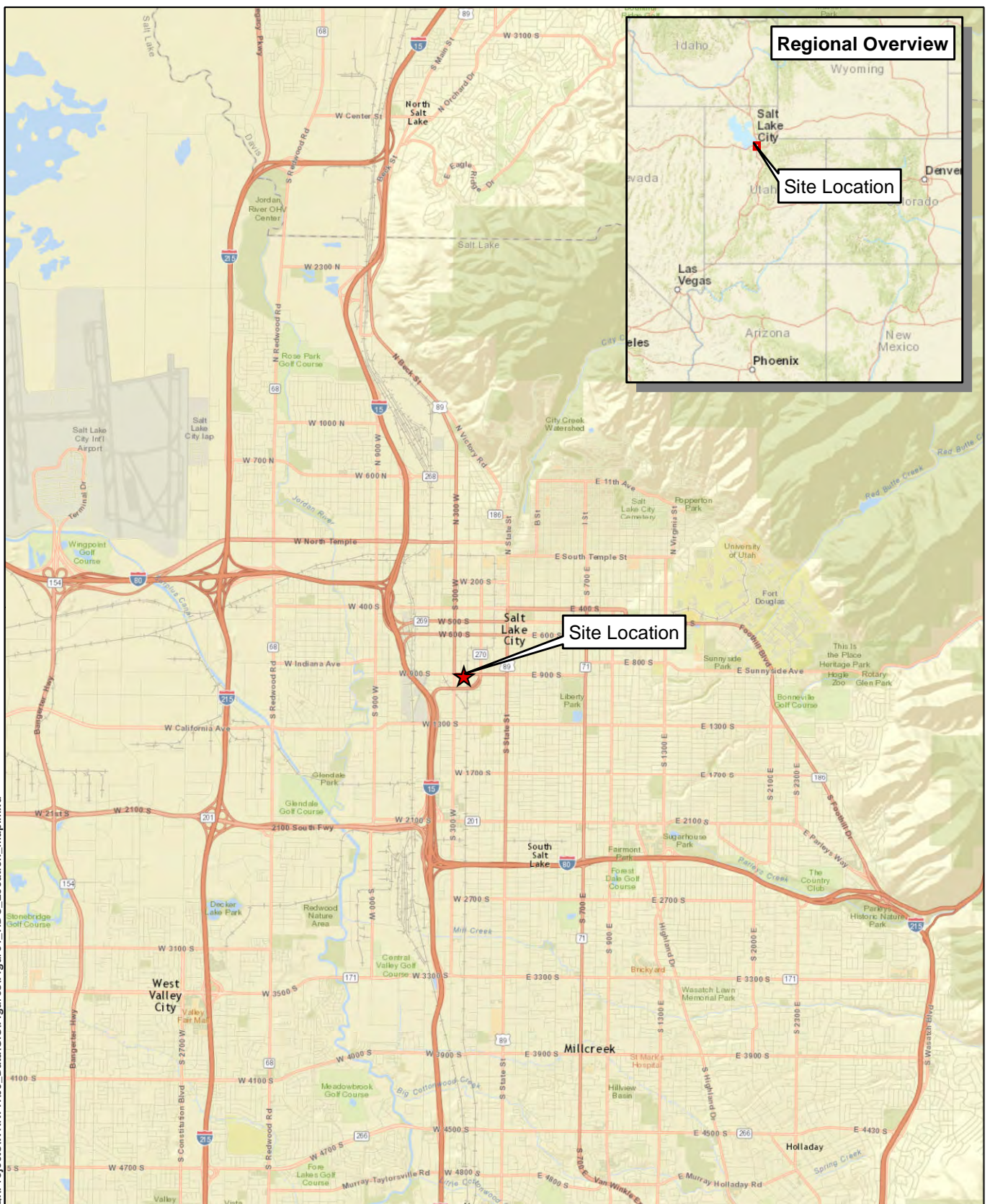
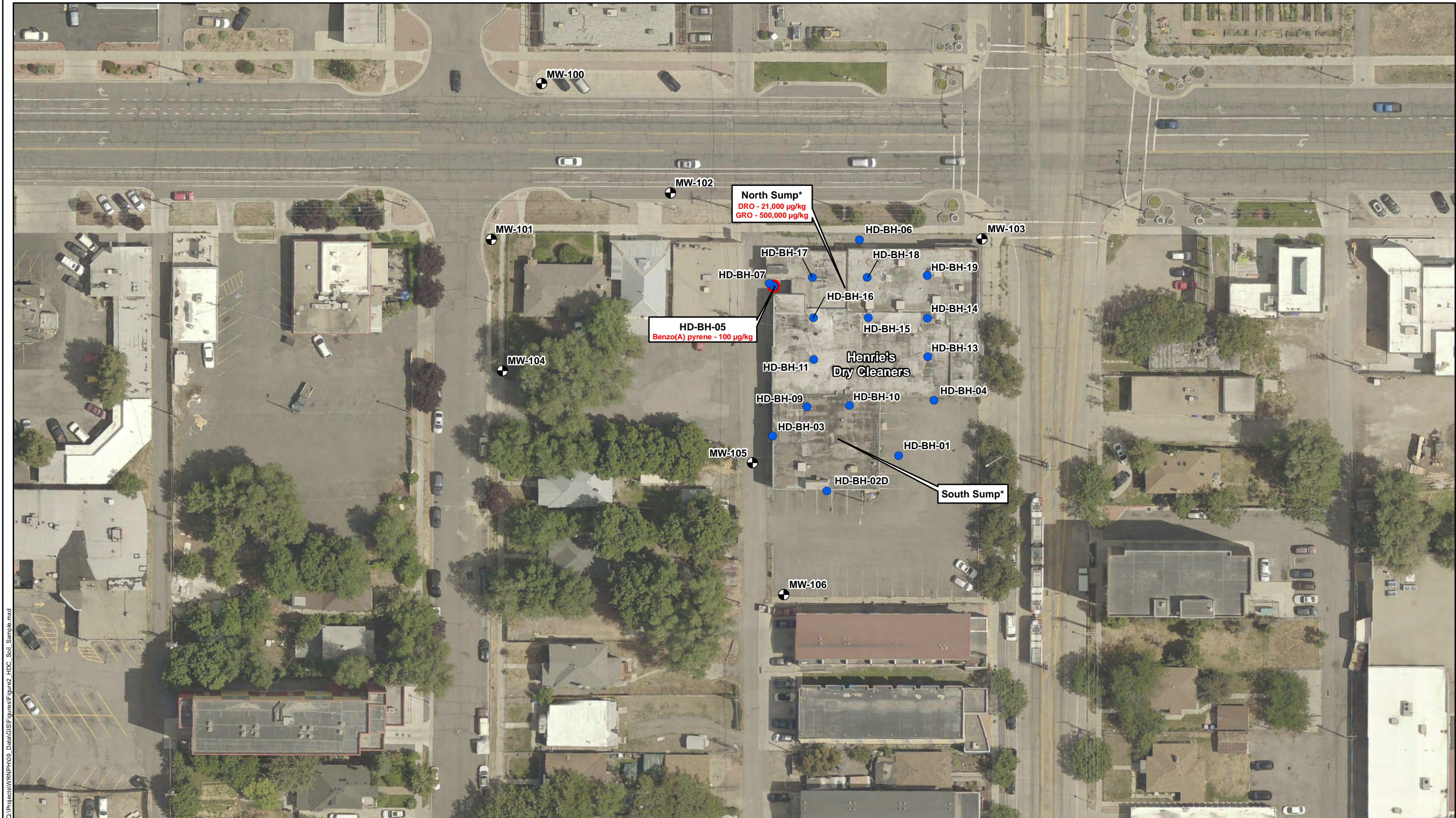





Figure C-5 Location Map
Henrie's Dry Cleaners
Salt Lake City, UT

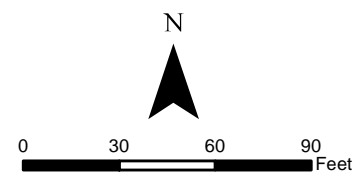


0 1 2 3 Miles



Q:\Projects\WRNPH09_Data\GIS\Figures\Figure2_HDC_Soil_Sample.mxd

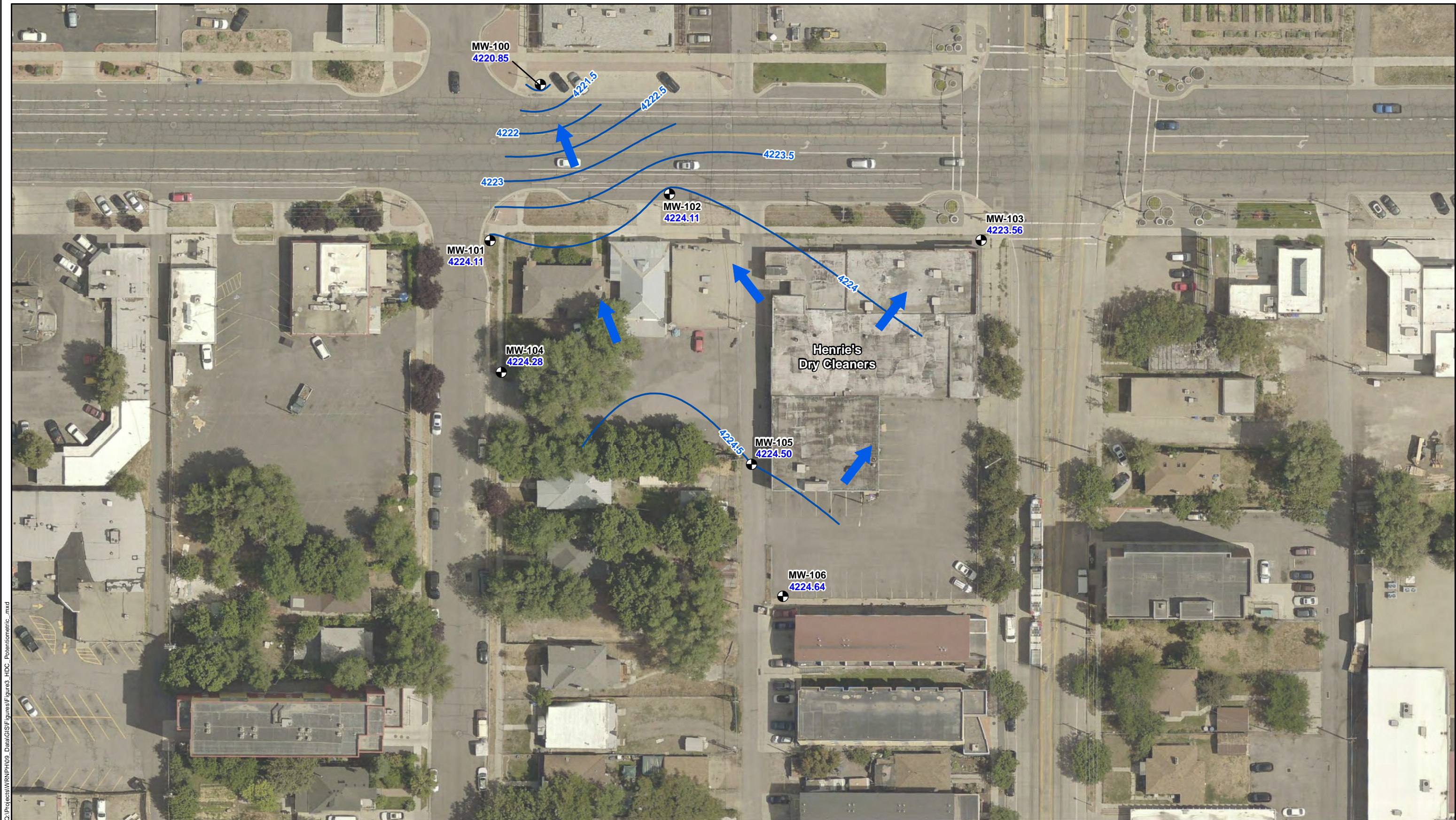
-  AECOM Well - No RSL exceedances
-  Weston Boring - No RSL exceedance reported
-  Weston Boring - RSL exceedance reported



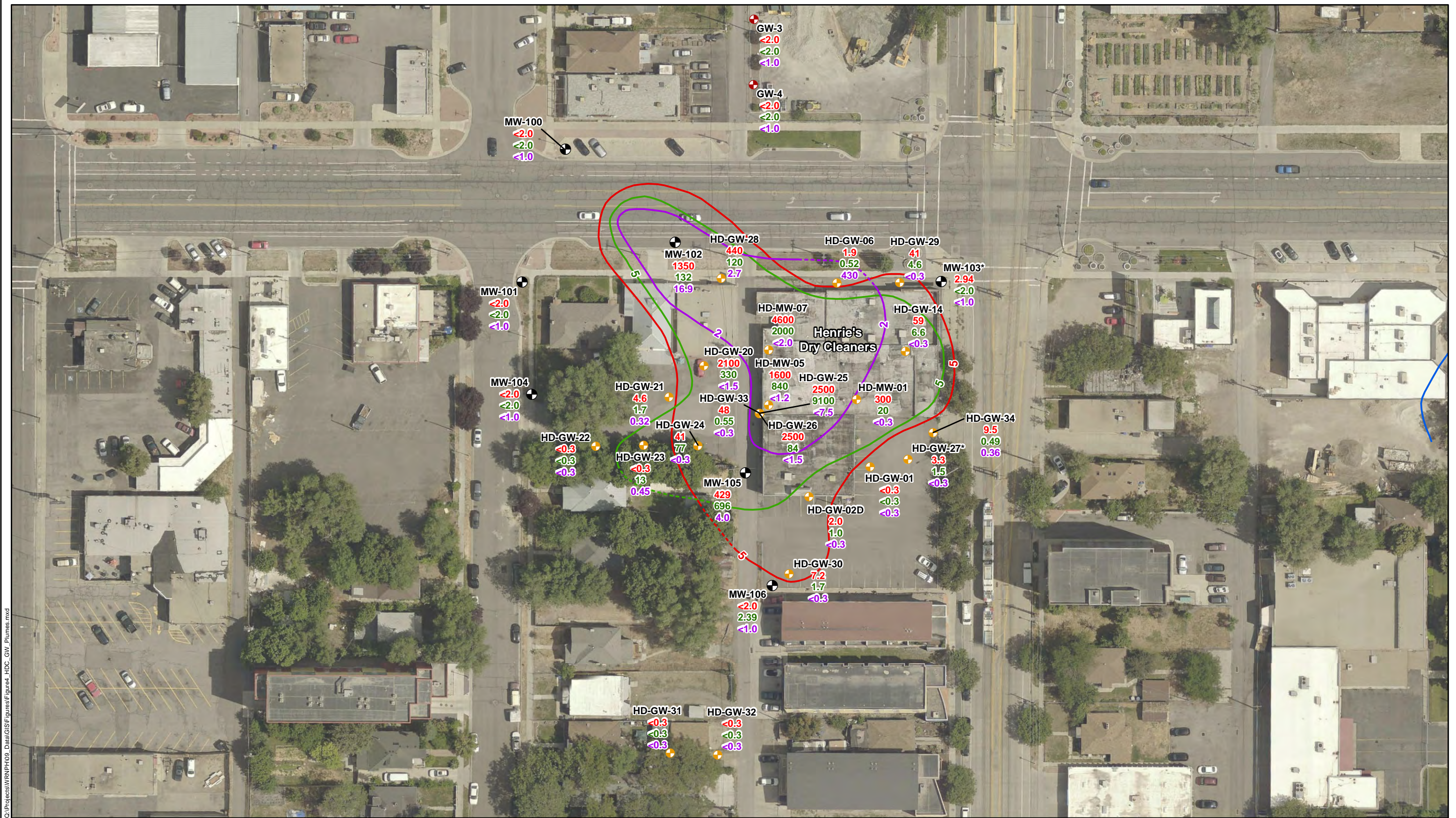
Notes:
 * = approximate location
 ft amsl = feet above mean sea level
 - Only results exceeding US EPA RSLs are shown on map
 - Weston locations HD-BH-05, HD-BH-08, and HD-BH-12 are unknown and are not shown on Figure 2. It should be noted that these locations did not exceed any EPA RSLs

Figure C-6 Soil Sample Location Map

Henrie's Dry Cleaners
 Salt Lake City, UT



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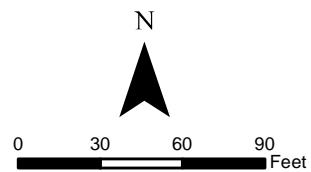
- AECOM Well ID
- PCE Concentration (µg/L)
- TCE Concentration (µg/L)
- VC Concentration (µg/L)

* = duplicate sample, the maximum of field duplicate and normal sample result is used

- Weston Groundwater Sample Location
- Wasatch Environmental Groundwater Sample Location

Analyte Isocontours (dashed where inferred)

- Tetrachloroethene (PCE) - 5 µg/L
- Trichloroethene (TCE) - 5 µg/L
- Vinyl Chloride (VC) - 2 µg/L



Notes:

- Historic sample locations from Weston and Wasatch Environmental included for informational purposes.

Figure C-8 Groundwater Impacted Area Map

Henri's Dry Cleaners
Salt Lake City, UT

Table C-7
Groundwater Field Parameter Summary

Well Identification ¹	Northing ²	Easting ²	Ground Surface Elevation ³ (ft amsl)	TOC Elevation ³ (ft amsl)	Date Measured	Top of Screen Elevation ³ (ft amsl)	Bottom of Screen Elevation ³ (ft amsl)	DTW ⁴ (ft BTOC)	TD ⁴ (ft BTOC)	Groundwater Elevation ³ (ft amsl)	Pump Intake Elevation ³ (ft amsl)	Calculated Purge (gal)	Actual Purge Volume (gal)	pH (s.u.)	Conductivity (mS/cm)	Temperature (°C)	ORP (mV)	Dissolved Oxygen (mg/L)
MW-100	7442143.8	1530124.4	4230.1	4228.88	4/27/2017	4224.61	4214.61	8.03	14.27	4220.85	4239.88	3.25	3.25	6.81	5.56	14.56	-68.9	8.27
MW-101	7442040.1	1530090.7	4230.3	4229.98	4/27/2017	4224.99	4214.99	5.87	14.99	4224.11	4240.98	4.77	4.75	7.64	2.268	11.55	8.6	9.98
MW-102	7442071.1	1530210.1	4231.0	4230.61	4/27/2017	4225.57	4215.57	6.50	15.04	4224.11	4241.61	4.47	4.5	7.05	2.86	10.77	39	9.03
MW-103	7442040.4	1530417.5	4231.0	4230.69	4/27/2017	4225.58	4215.58	7.13	15.11	4223.56	4241.69	4.17	4.25	7.21	2.871	13.48	-38.8	9.55
MW-104	7441952.6	1530098.2	4230.5	4230.18	4/27/2017	4224.86	4214.86	5.90	15.32	4224.28	4241.18	4.92	5	7.11	1.15	12.64	28.3	9.49
MW-105	7441891.4	1530264.8	4231.7	4231.03	4/27/2017	4226.16	4216.16	6.53	14.87	4224.50	4242.03	4.35	4.5	6.75	3.409	14.08	18.1	7.65
MW-106	7441803.3	1530285.6	4231.9	4231.32	4/27/2017	4226.30	4216.3	6.68	15.02	4224.64	4242.32	4.35	4.5	6.92	4.736	14.12	-92.7	7.81

Acronyms:
°C - degrees Celsius
amsl - above mean sea level
BTOC - below top of casing
DTW - depth to water
ft - feet
gal - gallon
mg/L - milligrams per liter
mS/cm - millisiemes per centimeter
mV - millivolts
ORP - oxygen reduction potential
s.u. - standard unit
TD - total depth

Notes:
1 - See Figure 2 for well locations.
2 - Utah State Plane, North Zone, North American Data (NAD) 83, US Survey Foot.
3 - North American Vertical Datum 1988, US Survey Foot.
4 - Depth to water and total depth measured using a Heron® electronic water level meter to +/- 0.01 foot.

Table C-8
Soil Sample Analytical Summary

Sample Location¹	Sample Identification	Sample Date	Sample Depth (ft bgs)	Analytical Test Method	Analyte	Results (ug/kg)	RSL Resident Soil² (ug/kg)	RSL Industrial Soil² (ug/kg)
MW-102	MW-102-0809	4/24/2017	8-9	SW 846-8260C	Tetrachloroethene	50.4	24000	100000
MW-103	MW-103-0607	4/25/2017	6-7	SW 846-8260C	Tetrachloroethene	33.8	24000	100000
MW-103	MW-X-0607	4/25/2017	6-7	SW 846-8260C	Tetrachloroethene	11.9	24000	100000
MW-105	MW-105-1112	4/25/2017	11-12	SW 846-8260C	cis-1,2-Dichloroethene	13.6	NE	NE
MW-105					Tetrachloroethene	65	24000	100000
MW-105					Trichloroethene	52.4	940	6000
MW-106	MW-106-1011	4/25/2017	10-11	SW 846-8260C	Tetrachloroethene	10.6	24000	100000

Acronyms

bgs - below ground surface

ft - feet

NE - Screen criteria not established

RSL - Regional Screening Levels

SW 846-8260C - USEPA Test Methods for evaluation of solid waste for volatile organic compounds

ug/kg - microgram per kilogram

USEPA - United States Environmental Protection Agency

Notes

Only analyses detected above laboratory reporting limits are summarized in table

1 - See Figure 2 for well locations.

2-USEPA RSL Summary Table (TR=1, HQ=1), https://www.epa.gov/sites/production/files/2016-06/documents/master_sl_table_run_may2016.pdf

3-**Bold** - indicates the detected concentration exceeded USEPA RSL

Table C-9
Groundwater Sample Analytical Summary

Sample Identification ⁴	Sample Date	Analytical Test Method	Analyte	Results (ug/kg) ³	USEPA MCL ¹	USEPA Tap Water ¹
				ug/L	ug/L	ug/L
MW-100	4/27/2017	SW 846-8260C	Ethyl acetate	20.2	NE	140
MW-101	4/27/2017	SW 846-8260C	Isopropyl alcohol	185	NE	NE
MW-102	4/27/2017	SW 846-8260C	1,1-Dichloroethene	19.6	NE	NE
	4/27/2017	SW 846-8260C	cis-1,2-Dichloroethene	7,370	NE	NE
	4/27/2017	SW 846-8260C	Tetrachloroethene	1,350	5	11
	4/27/2017	SW 846-8260C	trans-1,2-Dichloroethene	110	NE	NE
	4/27/2017	SW 846-8260C	Trichloroethene	132	5	0.49
	4/27/2017	SW 846-8260C	Vinyl chloride	16.9	2	0.019
MW-103	4/27/2017	SW 846-8260C	cis-1,2-Dichloroethene	37	NE	NE
	4/27/2017	SW 846-8260C	Tetrachloroethene	2.94	5	11
	4/27/2017	SW 846-8260C	trans-1,2-Dichloroethene	8.14	NE	NE
MW-X (Field Duplicate of MW-103)	4/27/2017	SW 846-8260C	cis-1,2-Dichloroethene	37.2	NE	NE
	4/27/2017	SW 846-8260C	Tetrachloroethene	2.8	5	11
	4/27/2017	SW 846-8260C	trans-1,2-Dichloroethene	8.45	NE	NE
MW-105	4/27/2017	SW 846-8260C	cis-1,2-Dichloroethene	592	NE	NE
	4/27/2017	SW 846-8260C	Isopropyl alcohol	110	NE	NE
	4/27/2017	SW 846-8260C	Tetrachloroethene	429	5	11
	4/27/2017	SW 846-8260C	trans-1,2-Dichloroethene	6.92	NE	NE
	4/27/2017	SW 846-8260C	Trichloroethene	696	5	0.49
MW-106	4/27/2017	SW 846-8260C	cis-1,2-Dichloroethene	12.4	NE	NE
	4/27/2017	SW 846-8260C	Isopropyl alcohol	72.5	NE	NE
	4/27/2017	SW 846-8260C	Trichloroethene	2.39	5	0.49

Acronyms

USEPA - United States Environmental Protection Agency

SW 846-8260C - USEPA Test Methods for evaluation of solid waste for volatile organic compounds

NE - USEPA regional screening level not established

MCL - USEPA Maximum Contaminate Level

ug/L - microgram per liter

Notes

1 - USEPA Regional Screening Levels (RSL) Summary Table (TR=1, HQ=1), https://www.epa.gov/sites/production/files/2016-06/documents/master_sl_table_run_may2016.pdf

2 - Only analyses detected above laboratory reporting limits summarized in this table

3 - **Bold** - indicates the detected concentration exceeded USEPA MCL

4 - See Figure 2 for well locations.

Tables and Figures Extracted from Wasatch Environmental, 2020

Table C-10
Soil Analytical Data - VOCs
Former Henrie's Dry Cleaner
906 South 200 West
Salt Lake City, Utah

all concentrations are expressed in micrograms per kilogram (µg/kg) except as noted otherwise

Sample I.D.	PID Reading (ppm)	Depth (feet)	Sample Collection Date	Volatile Organic Compounds																						
				Tetrachloroethene (PCE)	1,1-Dichloroethene	1,2-Dichlorobenzene	1,4-Dichlorobenzene	Acetone	Benzene	Carbon disulfide	Chlorobenzene	Chloroform	cis-1,2-Dichloroethene	Cyclohexane	Ethylbenzene	Isopropylbenzene	Methylcyclohexane	Methylene chloride	Naphthalene	Toluene	trans-1,2-Dichloroethene	Trichloroethene (TCE)	Vinyl chloride	m,p-Xylene	o-Xylene	Xylenes, Total
GP-1-7'	0.1	7	4/16/2018	86,000	< 317	< 317	< 317	< 1,580	38	< 317	< 317	71.3	2,180	< 317	31.7	< 317	155	2,620	< 317	127	119	6,000	< 158	---	---	231
GP-1-9'	44.6	9	4/16/2018	< 2.56	< 2.56	< 2.56	< 2.56	45.8	< 2.56	< 2.56	< 2.56	< 2.56	59.5	3.12	< 2.56	< 2.56	3.01	< 6.41	< 2.56	6.62	< 2.56	< 2.56	< 1.28	---	---	3.28
GP-2-8'	17.1	8	4/16/2018	141	< 2.75	< 2.75	< 2.75	39.3	< 2.75	< 2.75	< 2.75	< 2.75	13.0	< 2.75	< 2.75	< 2.75	< 6.88	< 2.75	6.36	< 2.75	< 2.75	7.91	< 1.38	---	---	< 2.75
GP-2-11'	0.4	11	4/16/2018	12.7	< 2.18	< 2.18	< 2.18	17.3	2.48	< 2.18	< 2.18	< 2.18	3.57	3.99	< 2.18	< 2.18	4.37	< 5.44	< 2.18	8.64	< 2.18	< 2.18	< 1.09	---	---	2.93
GP-3-5'	0.0	5	4/16/2018	5.50	< 2.64	< 2.64	< 2.64	< 13.2	< 2.64	< 2.64	< 2.64	< 2.64	< 2.64	< 2.64	< 2.64	< 2.64	< 2.64	< 6.59	< 2.64	3.69	< 2.64	< 2.64	< 1.32	---	---	< 2.64
GP-3-10'	0.0	10	4/16/2018	< 2.20	< 2.20	< 2.20	< 2.20	< 11.0	< 2.20	< 2.20	< 2.20	< 2.20	7.35	< 2.20	< 2.20	< 2.20	< 2.20	< 5.50	< 2.20	4.74	< 2.20	< 2.20	< 1.10	---	---	2.31
GP-4-5'	1.1	5	4/16/2018	1,810	< 2.63	< 2.63	< 2.63	< 13.1	< 2.63	< 2.63	< 2.63	< 2.63	< 2.63	2.64	< 2.63	< 2.63	< 2.63	< 6.57	< 2.63	4.45	< 2.63	9.77	< 1.31	---	---	< 2.63
GP-4-10'	4.4	10	4/16/2018	6,570	< 2.27	< 2.27	< 2.27	18.8	< 2.27	< 2.27	< 2.27	< 2.27	20.4	2.41	< 2.27	< 2.27	2.34	< 5.69	< 2.27	4.16	< 2.27	74.0	< 1.14	---	---	< 2.27
GP-5-5'	2.0	5	4/16/2018	4,390	< 3.48	< 3.48	< 3.48	< 17.4	< 3.48	< 3.48	< 3.48	< 3.48	< 3.48	< 3.48	< 3.48	< 3.48	3.95	< 8.69	< 3.48	10.7	< 3.48	38.7	< 1.74	---	---	5.11
GP-5-9'	1.0	9	4/16/2018	10,100	< 2.27	< 2.27	< 2.27	< 11.4	< 2.27	< 2.27	< 2.27	< 2.27	7.07	< 2.27	< 2.27	< 2.27	< 2.27	< 5.68	< 2.27	2.42	< 2.27	5.98	< 1.14	---	---	< 2.27
GP-6-5'	0.2	5	4/16/2018	3,220	< 2.87	< 2.87	< 2.87	< 14.3	< 2.87	< 2.87	< 2.87	< 2.87	5.88	< 2.87	< 2.87	< 2.87	< 2.87	< 7.17	< 2.87	4.37	< 2.87	9.59	< 1.43	---	---	< 2.87
GP-6-10'	0.1	10	4/16/2018	34.6	< 2.14	< 2.14	< 2.14	< 10.7	< 2.14	< 2.14	< 2.14	< 2.14	4.53	< 2.14	< 2.14	< 2.14	< 5.34	< 2.14	2.89	< 2.14	< 2.14	< 1.07	---	---	< 2.14	
GP-7-6'	0.0	6	4/16/2018	18.4	< 2.49	< 2.49	< 2.49	< 12.5	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 6.23	< 2.49	4.00	< 2.49	< 2.49	< 1.25	---	---	< 2.49
GP-7-10'	0.0	10	4/16/2018	20.8	< 2.30	< 2.30	< 2.30	< 11.5	< 2.30	< 2.30	< 2.30	< 2.30	< 2.30	2.51	< 2.30	< 2.30	2.35	< 5.74	< 2.30	5.44	< 2.30	< 2.30	< 1.15	---	---	< 2.30
GP-8-2'	55.5	2	4/19/2018	59,900	< 2.14	< 2.14	< 2.14	11.0	2.78	< 2.14	< 2.14	< 2.14	< 2.14	4.05	< 2.14	< 2.14	4.46	< 5.36	< 2.14	8.41	< 2.14	12.7	< 1.07	---	---	3.20
GP-8-6'	28.7	6	4/19/2018	64,000	< 2.65	< 2.65	< 2.65	< 13.3	< 2.65	< 2.65	< 2.65	< 2.65	< 2.65	9.72	< 2.65	< 2.65	9.96	< 6.64	< 2.65	7.61	< 2.65	15.4	< 1.33	---	---	3.16
GP-9-1'	17.1	1	4/19/2018	22,700	< 2.19	< 2.19	< 2.19	40.1	< 2.19	< 2.19	< 2.19	2.30	3.68	5.17	< 2.19	< 2.19	5.77	< 5.48	< 2.19	6.69	< 2.19	32.5	< 1.10	---	---	4.69
GP-9-15'	1,064	15	4/19/2018	311,000	< 2.24	< 2.24	< 2.24	< 11.2	< 2.24	< 2.24	< 2.24	< 2.24	326	< 2.24	< 2.24	25.8	2.56	< 5.59	< 2.24	3.20	2.26	598	< 1.12	---	---	2.88
GP-10-4'	0.0	4	4/19/2018	544	< 4.16	< 4.16	< 4.16	< 20.8	< 4.16	< 4.16	< 4.16	< 4.16	4.70	< 4.16	< 4.16	< 4.16	< 4.16	< 10.4	< 4.16	11.4	< 4.16	< 4.16	< 2.08	---	---	4.76
GP-10-8'	0.0	8	4/19/2018	31.5	< 2.65	< 2.65	< 2.65	33.5	< 2.65	< 2.65	< 2.65	< 2.65	7.61	< 2.65	< 2.65	< 2.65	2.68	< 6.63	< 2.65	5.15	< 2.65	< 2.65	< 1.33	---	---	< 2.65
GP-11-4'	0.0	4	4/19/2018	214	< 2.43	< 2.43	< 2.43	< 12.2	2.78	< 2.43	< 2.43	4.52	3.18	5.82	< 2.43	< 2.43	5.75	< 6.08	< 2.43	6.71	< 2.43	5.50	< 1.22	---	---	< 2.43
GP-11-8'	0.0	8	4/19/2018	10.1	< 2.57	< 2.57	< 2.57	< 12.8	< 2.57	< 2.57	< 2.57	< 2.57	6.84	< 2.57	< 2.57	< 2.57	5.25	< 6.42	< 2.57	6.41	< 2.57	< 2.57	< 1.28	---	---	< 2.57
GP-12-5'	190.1	5	4/19/2018	5,240	< 2.84	< 2.84	< 2.84	< 14.2	4.73	< 2.84	< 2.84	< 2.84	< 2.84	14.6	< 2.84	< 2.84	16.7	< 7.10	< 2.84	15.1	< 2.84	4.37	< 1.42	---	---	6.54
GP-12-9'	1.1	9	4/19/2018	1,890	< 2.67	< 2.67	< 2.67	< 13.3	2.77	< 2.67	< 2.67	< 2.67	26.2	6.33	< 2.67	< 2.67	6.06	< 6.66	< 2.67	6.38	< 2.67	5.33	< 1.33	---	---	< 2.67
GP-13-6'	2.1	6	4/19/2018	59.1	< 2.85	< 2.85	< 2.85	< 14.2	3.19	< 2.85	< 2.85	< 2.85	< 2.85	7.28	< 2.85	< 2.85	7.23	< 7.12	< 2.85	6.92	< 2.85	< 2.85	< 1.42	---	---	< 2.85
GP-13-10'	1.8	10	4/19/2018	212	< 2.22	< 2.22	< 2.22	< 11.1	< 2.22	< 2.22	< 2.22	< 2.22	2.67	3.47	< 2.22	< 2.22	4.06	< 5.54	< 2.22	5.45	< 2.22	3.03	< 1.11	---	---	2.46
GP-14-5'	2.8	5	4/19/2018	2,700	< 2.84	< 2.84	< 2.84	< 14.2	6.85	< 2.84	< 2.84	3.37	10.2	13.2	< 2.84	< 2.84	16.6	< 7.10	< 2.84	16.8	< 2.84	16.3	< 1.42	---	---	3.75
GP-14-10'	1.9	10	4/19/2018	< 2.29	< 2.29	< 2.29	< 2.29	< 11.5	< 2.29	< 2.29	< 2.29	< 2.29	3.36	< 2.29	< 2.29	< 2.29	2.71	< 5.74	< 2.29	3.28	< 2.29	< 2.29	1.37	---	---	< 2.29
GP-15-4'	3.8	4	4/19/2018	309	< 2.65	< 2.65	< 2.65	< 13.3	< 2.65	< 2.65	< 2.65	< 2.65	8.95	< 2.65	7.56	< 2.65	< 2.65	< 6.63	< 2.65	3.17	< 2.65	5.17	< 1.33	---	---	49.5
GP-15-8'	6.8	8	4/19/2018	156	< 2.44	< 2.44	< 2.44	< 12.2	< 2.44	< 2.44	< 2.44	< 2.44	< 2.44	2.68	< 2.44	< 2.44	2.99	< 6.10	< 2.44	2.82	< 2.44	2.99	< 1.22	---	---	< 2.44
GP-18-17'	36.6	17	1/10/2019	40,200	7.26	< 2.38	< 2.38	< 11.9	< 2.38	< 2.38	< 2.38	< 2.38	207	< 2.38	< 2.38	< 2.38	< 2.38	< 5.96	< 2.38	< 2.38	4.67	1,130	2.27	< 2.38	< 2.38	< 2.38
GP-18-28'	12,453	28	1/10/2019	48,700	< 142	< 142	< 142	< 710	< 142	< 142	< 142	< 142	< 142	< 142	< 142	< 142	< 142	< 355	< 142	< 142	< 142	< 142	< 71.0	< 142	< 142	< 142
GP-180-28'	12,453	28	1/10/2019	56,200	< 146	< 146	< 146	< 730	< 146	< 146	< 146	< 146	< 146	< 146	< 146	< 146	< 146	< 365	< 146	< 146	< 146	< 146	< 73.0			

Table C-11
Groundwater Analytical Data
Former Henrie's Dry Cleaner
906 South 200 West
Salt Lake City, Utah

all concentrations are expressed in micrograms per liter (µg/L) except as noted otherwise

Sample I.D.	Screen Interval (feet)	Top of Casing ¹ Elevations (feet)	Depth to Water (feet below top of casing)	Groundwater Elevations (feet)	Sample Collection Date	Volatile Organic Compounds															
						Tetrachloroethene (PCE)	1,1-Dichloroethene	2-Butanone	2-Hexanone	4-Methyl-2-pentanone	Acetone	Benzene	cis-1,2-Dichloroethene	Ethylbenzene	Toluene	trans-1,2-Dichloroethene	Trichloroethene (TCE)	Vinyl chloride	Xylenes, Total	Naphthalene	
GP-1	11 - 15	---	7	---	4/16/18	4.07	< 2.00	<10.0	<5.00	<5.00	< 10.0	< 2.00	305	< 2.00	< 2.00	4.32	2.15	21.5	< 2.00	<0.0984	
GP-3	11 - 15	---	6	---	4/16/18	< 2.00	< 2.00	<10.0	<5.00	<5.00	< 10.0	< 2.00	108	< 2.00	< 2.00	< 2.00	< 2.00	< 1.00	< 2.00	<0.0973	
GP-6	11 - 15	---	5	---	4/16/18	127	< 2.00	<10.0	<5.00	<5.00	< 10.0	< 2.00	27.4	< 2.00	< 2.00	< 2.00	8.00	< 1.00	< 2.00	<0.0995	
GP-7	11 - 15	---	5	---	4/16/18	11.4	< 2.00	<10.0	<5.00	<5.00	< 10.0	< 2.00	12.0	< 2.00	< 2.00	< 2.00	< 2.00	< 1.00	< 2.00	<0.102	
GP-9	11 - 15	---	6	---	4/19/18	44,400	28.6	<10.0	<5.00	<5.00	< 10.0	< 2.00	10,000	< 2.00	< 2.00	154	4,920	12.1	< 2.00	<0.0998	
GP-11	11 - 15	---	6	---	4/19/18	11.2	2.72	<10.0	<5.00	<5.00	13.8	7.12	692	< 2.00	8.93	15.9	2.91	< 1.00	4.05	<0.0991	
GP-13	11 - 15	---	6	---	4/19/18	547	< 2.00	<10.0	<5.00	<5.00	< 10.0	< 2.00	465	< 2.00	< 2.00	14.8	102	1.03	< 2.00	<0.0983	
GP-15	11 - 15	---	6	---	4/19/18	446	< 2.00	<10.0	<5.00	<5.00	< 10.0	2.93	101	2.68	4.00	4.16	21.2	< 1.00	14.4	<0.0985	
GP-16	11 - 15	---	10	---	1/10/19	<2.00	<2.00	<10.0	<5.00	<5.00	<10.0	<2.00	1,150	<2.00	<2.00	2.61	<2.00	<1.00	<2.00	<2.00	
GP-160	11 - 15	---	10	---	1/10/19	<2.00	<2.00	<10.0	<5.00	<5.00	<10.0	<2.00	794	<2.00	<2.00	2.91	<2.00	<1.00	<2.00	<2.00	
GP-17	11 - 15	---	10	---	1/10/19	<2.00	<2.00	<10.0	<5.00	<5.00	<10.0	<2.00	45.7	<2.00	<2.00	<2.00	<2.00	<1.00	<2.00	<2.00	
GP-18-23'	21 - 25	---	10	---	1/10/19	181,000	505	<1,000	<500	<500	<1,000	<200*	<200*	<200	<200	<200*	574	123	<200	<200	
GP-18-33'	31 - 35	---	10	---	1/10/19	120,000	<2,000*	<10,000	<5,000	<5,000	<10,000	<2,000*	<2,000*	<2,000*	<2,000*	<2,000*	<2,000*	<1,000*	<2,000	<2,000	
GP-18-58'	56 - 60	---	10	---	1/10/19	61,400	<20.0*	<100	<50.0	<50.0	<100	<20.0*	<20.0	<20.0	<20.0	<20.0	51.9	<10.0*	<20.0	<20.0	
GP-23	20 - 24	---	7	---	2/20/19	1,790	3.45	<10.0	<5.00	<5.00	<10	<2.00	8.54	<2.00	<2.00	2.03	53.9	3.52	---	<2.00	
GP-23-DEEP	56 - 60	---	7	---	2/20/19	6,350	3.16	<10.0	<5.00	<5.00	<10.0	<2.00	38.1	<2.00	<2.00	<2.00	200	<1.00	---	<2.00	
GP-24	20 - 24	---	7	---	2/20/19	79.8	42.5	<10.0	<5.00	<5.00	<10.0	<2.00	964	<2.00	<2.00	78.0	528	19.7	---	<2.00	
GP-24-DEEP	56 - 60	---	7	---	2/20/19	38.8	<20.0*	<100	<50.0	<50.0	<100	<20.0*	<20.0	<20.0	<20.0	<20.0	<20.0*	<10.0*	---	<20.0	
GP-240-DEEP	56 - 60	---	7	---	2/20/19	43.7	<20.0*	<100	<50.0	<50.0	<100	<20.0*	<20.0	<20.0	<20.0	<20.0	<20.0*	<10.0*	---	<20.0	
GP-25	21 - 25	---	7	---	2/21/19	107	<20.0*	<100	<50.0	<50.0	<100	<20.0*	<20.0	<20.0	<20.0	<20.0	138	<10.0*	---	<20.0	
GP-250	21 - 25	---	7	---	2/21/19	81.6	<20.0*	<100	<50.0	<50.0	<100	<20.0*	<20.0	<20.0	<20.0	<20.0	132	<10.0*	---	<20.0	
GP-25-DEEP	56 - 60	---	7	---	2/21/19	<20.0*	<20.0*	<100	<50.0	<50.0	<100	<20.0*	<20.0	<20.0	<20.0	<20.0	<20.0*	<10.0*	---	<20.0	
GP-26	21 - 25	---	7	---	2/21/19	25.5	<20.0*	<100	<50.0	<50.0	<100	<20.0*	80.9	<20.0	<20.0	<20.0	131	<10.0*	---	<20.0	
GP-26-DEEP	56 - 60	---	7	---	2/21/19	<20.0*	<20.0*	<100	<50.0	<50.0	<100	<20.0*	<20.0	<20.0	<20.0	<20.0	<20.0*	<10.0*	---	<20.0	
GP-27	21 - 25	---	7	---	2/22/19	170,000	220	<1000	<500	<500	<1,000	<200*	234	<200	<200	<200*	2,950	<100*	---	<200	
GP-27-DEEP	56 - 60	---	7	---	2/22/19	14,300	<100*	<500	<250	<250	<500	<100*	<100*	<100	<100	<100	<100*	<50*	---	<100	
GP-28	21 - 25	---	7	---	2/22/19	110	<20.0*	<100	<50.0	73.9	<100	<20.0*	<20.0	<20.0	<20.0	<20.0	<20.0*	<10.0*	---	<20.0	
GP-28-DEEP	56 - 60	---	7	---	2/22/19	44.3	<20.0*	<100	<50.0	<50.0	<100	<20.0*	<20.0	<20.0	<20.0	<20.0	<20.0*	<10.0*	---	<20.0	
Low Flow Sampling Event March 2019																					
MW-102M	20 - 30	4230.44	6.75 †	4223.69	3/8/19	66.0	<20.0*	<100	<50.0	<50.0	<100	<20.0*	39.6	<20.0	<20.0	<20.0	<20.0*	<10.0*	---	<20.0	
MW-102D	50 - 60	4230.93	-0.98 †	4231.91	3/8/19	3.72	<2.00	<10.0	<5.00	<5.00	<10.0	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<1.00	---	<2.00	
MW-104M	20 - 30	4229.82	6.60 †	4223.22	3/8/19	3.10	<2.00	<10.0	<5.00	<5.00	10.2	<2.00	<2.00	<2.00	<2.00	<2.00	5.38	<1.00	---	<2.00	
MW-104D	50 - 60	4230.13	-2.32 †	4232.45	3/8/19	<2.00	<2.00	<10.0	<5.00	<5.00	<10.0	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<1.00	---	<2.00	
MW-1040D	50 - 60	4230.13	-2.32 †	4232.45	3/8/19	<2.00	<2.00	<10.0	<5.00	<5.00	<10.0	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<1.00	---	<2.00	
HD-MW-07M	20 - 30	4231.27	7.86 †	4223.41	3/8/19	1,710	<100*	<500	<250	<250	<500	<100*	3,000	<100	<100	<100*	5,120	<50.0*	---	<100	
HD-MW-07D	51 - 61	4231.65	-1.80 †	4233.45	3/8/19	<2.00	<2.00	<10.0	<5.00	<5.00	<10.0	<2.00	<2.00	<2.00	<2.00	<2.00	3.84	<1.00	---	<2.00	
Hydropunch Samples May 2020																					
Hydro-1	100 - 103	---	---	---	5/19/20	<20.0**	<20.0**	<100	<50.0	<50.0	<100	<20.0*	<20.0	<20.0	<20.0	<20.0	<20.0*	<10.0**	---	<20.0	
Hydro-2	85 - 88	---	---	---	5/19/20	29.0	<20.0**	<100	<50.0	<50.0	<100	<20.0*	3.4 (J)	<20.0	<20.0	<20.0	<20.0	12.5 (J)	<10.0**	---	<20.0
Hydro-20	85 - 88	---	---	---	5/19/20	10 (J)	<20.0**	<100	<50.0	<50.0	<100	<20.0*	<20.0	<20.0	<20.0	<20.0	<20.0	4.8 (J)	<10.0**	---	<20.0
Hydro-3	75 - 78	---	---	---	5/19/20	0.98 (J)	<2.00	14.5	49.1	6.39	69.7	0.26 (J)	0.41 (J)	<2.00	0.33 (J)	<2.00	0.97 (J)	<1.00	---	<2.00	
Hydro-4	68 - 71	---	---	---	5/19/20	<2.00	<2.00	17.1	27.7	55.9	25.8	0.21 (J)	<2.00	<2.00	0.49 (J)	<2.00	<2.00	<1.00	---	1.35 (J)	
Monitoring Well Installation Samples June 2020																					
MW-100M	20 - 30	4229.658	6.21	4223.45	6/17/20	<2.00	<2.00	<10.0	<5.00	<5.00	<10.0	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<1.00	---	<2.00	
MW-100MO	20 - 30	4229.658	6.21	4223.45	6/17/20	<2.00	<2.00	<10.0	<5.00	<5.00	<10.0	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<1.00	---	<2.00	
MW-107	5 - 15	4231.444	7.46	4223.98	6/17/20	9.31	<2.00	<10.0	<5.00	<5.00	<10.0	<2.00	332	<2.00	<2.00	4.98	3.36	1.14	---	<2.00	
MW-107M	20 - 30	4231.360	7.40	4223.96	6/17/20	<2.00	<2.00	<10.0	<5.00	<5.00	<10.0	<2.00	158	<2.00	<2.00	2.53	<2.00	<1.00	---	<2.00	
MW-107D	50 - 60	4231.569	-0.54	4232.11	6/17/20	<2.00	<2.00	<10.0	<5.00	<5.00	<10.0	<2.00	<2.00	<2.00	&						

Table C-12
Historical Subsurface Soil Gas Analytical Data
Former Henries's Dry Cleaner
906 South 200 West
Salt Lake City, Utah

all concentrations are expressed in micrograms per cubic meter (µg/m³) except as noted otherwise

Sample ID	Sample Collection Date	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Tetrachloroethene (PCE)	Trichloroethene (TCE)	1,1-Dichloroethene	Vinyl chloride	2-Hexanone	Acetone	Carbon disulfide	2-Butanone	Dichlorodifluoromethane	n-Hexane	Chloroform	Benzene	4-methyl-2-pentanone	Cyclohexane	Methylene Chloride	Heptane	Toluene	Tetrahydrofuran	Ethylbenzene	m,p-Xylene	o-Xylene	1,3,5-Trimethylbenzene	1,2,4-Trimethylbenzene
Weston 2016																										
HD-SG-01	8/4/2016	1,600	2,100	2,300	94	2.6	4,000	120	490	21	210	2.3	20	39	21	540	110	14	20	23	9.0	3.6	9.2	4.2	2.8	13
HD-SG-02	8/4/2016	1.1	0.59	4,000	46	0.59	0.81	1.2	960	2.8	87	1.5	2.2	2.2	2.0	36	0.88	6.8	1.8	5.1	3.2	0.88	2.2	0.66	0.74	1.9
Wasatch 2019																										
SG-1	1/10/2019	<0.59	<0.59	75	<0.81	<0.59	<0.38	<1.3	8.9	0.84	20	2.5	0.77	1.1	0.74	1.5	<0.52	<0.52	<0.61	0.97	5.5	1.4	5.4	1.3	<1.5	<1.5
SG-2	1/10/2019	<0.59	<0.59	31	1.3	0.59	<0.38	<1.3	15	0.49	1.1	2.7	1.4	12	0.92	1.6	<0.52	0.65	1.2	7.2	<0.44	3.0	16	5.4	<1.5	4.2
U.S. EPA VISL Residential Target Sub-Slab and Exterior Soil Gas Concentraion		---	---	360	16	6,950	5.6	1,040	1,100,000	24,000	5,200	24,000	24,000	4.7	12	104,000	210,000	3,400	14,000	170,000	70,000	37	3,500	3,500	---	2,100
U.S. EPA VISL Commercial Target Sub-Slab and Exterior Soil Gas Concentraion		---	---	1,600	100	29,200	93	4,380	4,500,000	100,000	22,000	100,000	880,000	17.8	52	438,000	880,000	41,000	58,000	730,000	290,000	160	15,000	15,000	---	8,800

NOTES:

Only analytes that were detected at concentrations above the reporting limit in one or more samples are presented in the table.

< = Concentration was below the reporting limit

BOLD = Measured concentration is greater than the applicable United States (U.S.) Environmental Protection Agency (EPA) Vapor Intrusion Screening Level (VISL) online calculator spreadsheet (date 1-21-19), Residential Target Sub-slab Soil Gas Concentration (TCR = 1x10⁻⁶, THQ = 1)

= Measured concentration is greater than the applicable U.S. EPA VISL online calculator spreadsheet (date 1-21-19), Commercial Target Sub-slab Soil Gas Concentration (TCR = 1x10⁻⁶, THQ = 1)

--- = No U.S. EPA VISL Target Subslab Soil Gas Concentration has been established

Table C-13
Groundwater Chemistry Data
Former Henrie's Dry Cleaner
906 South 200 West
Salt Lake City, Utah

Sample I.D.	Screen Interval (feet)	Sample Collection Date	Depth to Water (feet below top of casing)	Temperature (C)	Specific (µS/cm)	pH	ORP (mv)	DO (mg/L)	Turbidity (NTU)
Low Flow Sampling Event March 2019									
MW-102M	20 - 30	3/8/19	6.85	9.24	1,397.1	7.62	-149.8	0.36	3,515.6
MW-102D	50 - 60	3/8/19	-0.333	9.82	1,469.1	7.20	-114.9	0.13	39.35
MW-104M	20 - 30	3/8/19	7.31	11.51	1,846.4	7.78	-156.0	0.15	178.98
MW-104D	50 - 60	3/8/19	-0.167	9.14	1,466.7	7.53	-117.1	0.19	132.24
HD-MW-07M	20 - 30	3/8/19	7.54	9.40	2,232.7	7.63	-103.6	0.21	57.51
HD-MW-07D	51 - 61	3/8/19	-0.417	8.74	2,138.8	7.26	-117.1	0.18	192.98
Monitoring Well Installation Samples June 2020									
MW-100M	20 - 30	6/17/20	6.21	16.23	1,299.8	6.95	-124.5	0.17	342.86
MW-107	5 - 15	6/17/20	7.46	16.75	1,657.1	7.57	18.6	0.17	13.13
MW-107M	20 - 30	6/17/20	7.40	17.44	1,469.3	7.08	-140.5	0.19	105.61
MW-107D	50 - 60	6/17/20	-0.54	20.13	1,099.8	6.81	-148.8	0.16	73.28
MW-108	5 - 15	6/17/20	7.69	15.70	4,510.3	7.15	-105.9	0.23	33.41
MW-108M	20 - 30	6/17/20	7.75	16.53	1,721.4	7.40	-156.7	0.22	128.93
MW-108D	50 - 60	6/27/20	-0.26	18.68	1,114.1	6.94	-153.6	0.14	41.66
MW-109M	20 - 30	6/17/20	6.80	16.58	1,529.5	6.99	-133.4	0.24	90.1
MW-109D	50 - 60	6/17/20	-1.22	19.35	1,084.6	7.44	-154.9	0.17	28.91

*All readings are final reading after stabilization



Environmental Science and Engineering

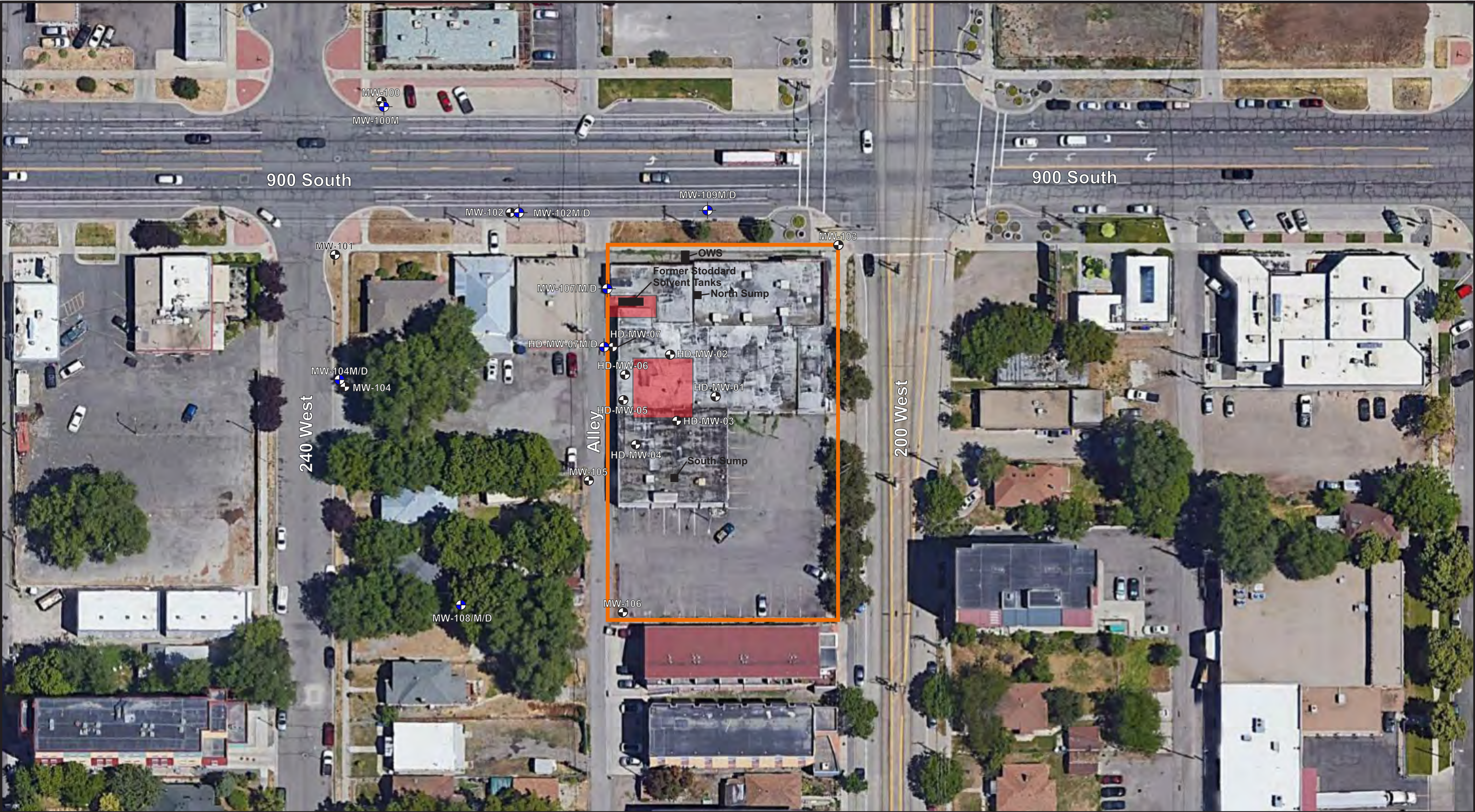
Site Location Map

Former Henries Dry Cleaner
906 South 200 West
Salt Lake City, Utah, 84101

PROJECT NO.: 2221-003G

DATE: August 13, 2020

FIGURE C-10



Previously Installed AECOM Monitoring Well

Site Property Boundary

Source Areas

Wasatch Installed Monitoring Well

Scale: 1" equals approximately 62'

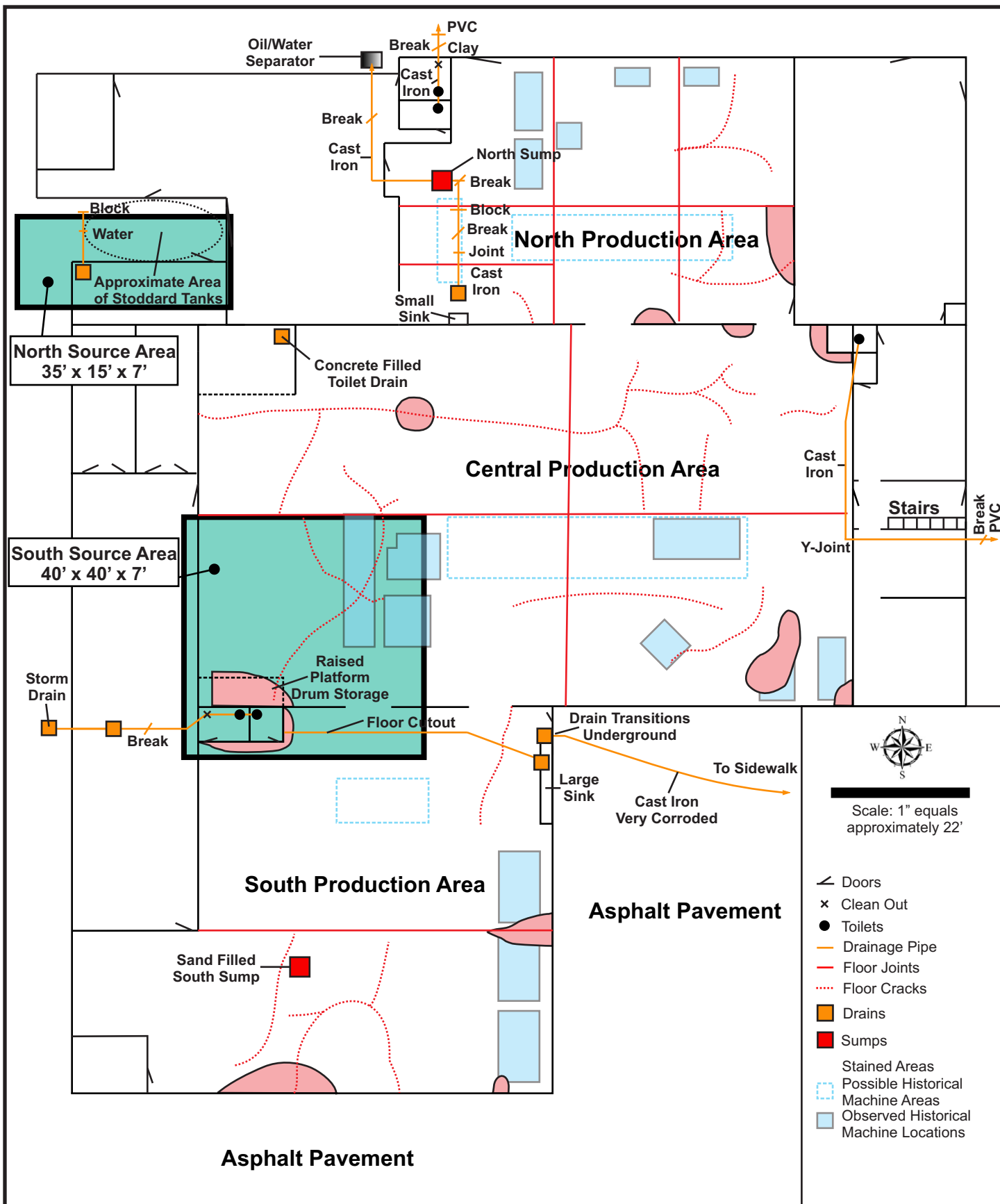
N
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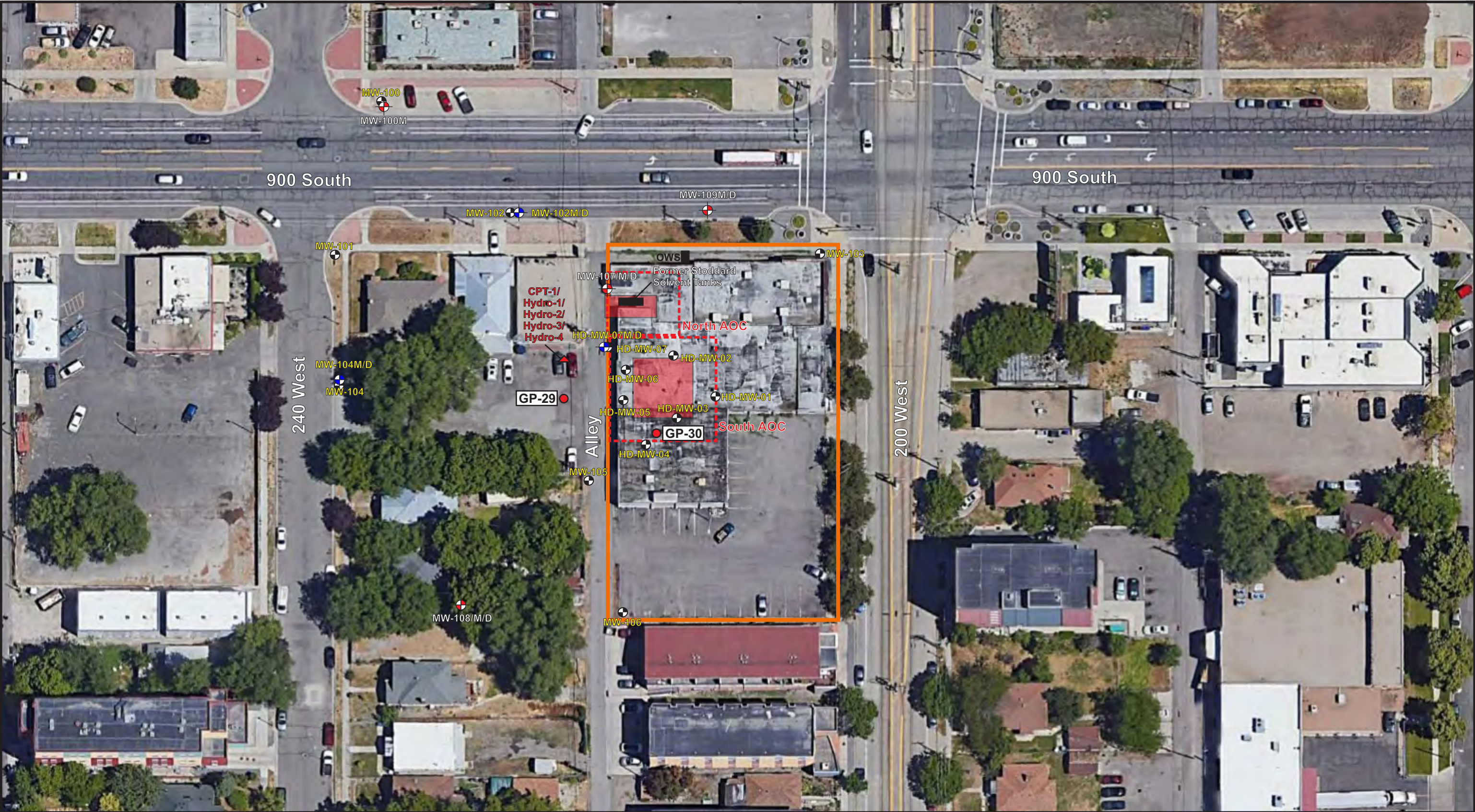
WASATCH
ENVIRONMENTAL
Environmental Science and Engineering

Site Feature Map

Former Henries Dry Cleaner
906 South 200 West, Salt Lake City, Utah

PROJECT NO.	DRAWING DATE	FIGURE
2221-003G	August 13, 2020	C-11





AOC Boundaries (North and South)

Site Property Boundary

Source Areas

Existing AECOM Shallow Monitoring Well

Existing Wasatch Clustered Monitoring Well Location

CPT/Hydropuch Sample Location

30 Foot Soil Sample Only Boring

New Wasatch Clustered Monitoring Well Location

N

W

E

S

Scale: 1" equals approximately 62'

WASATCH

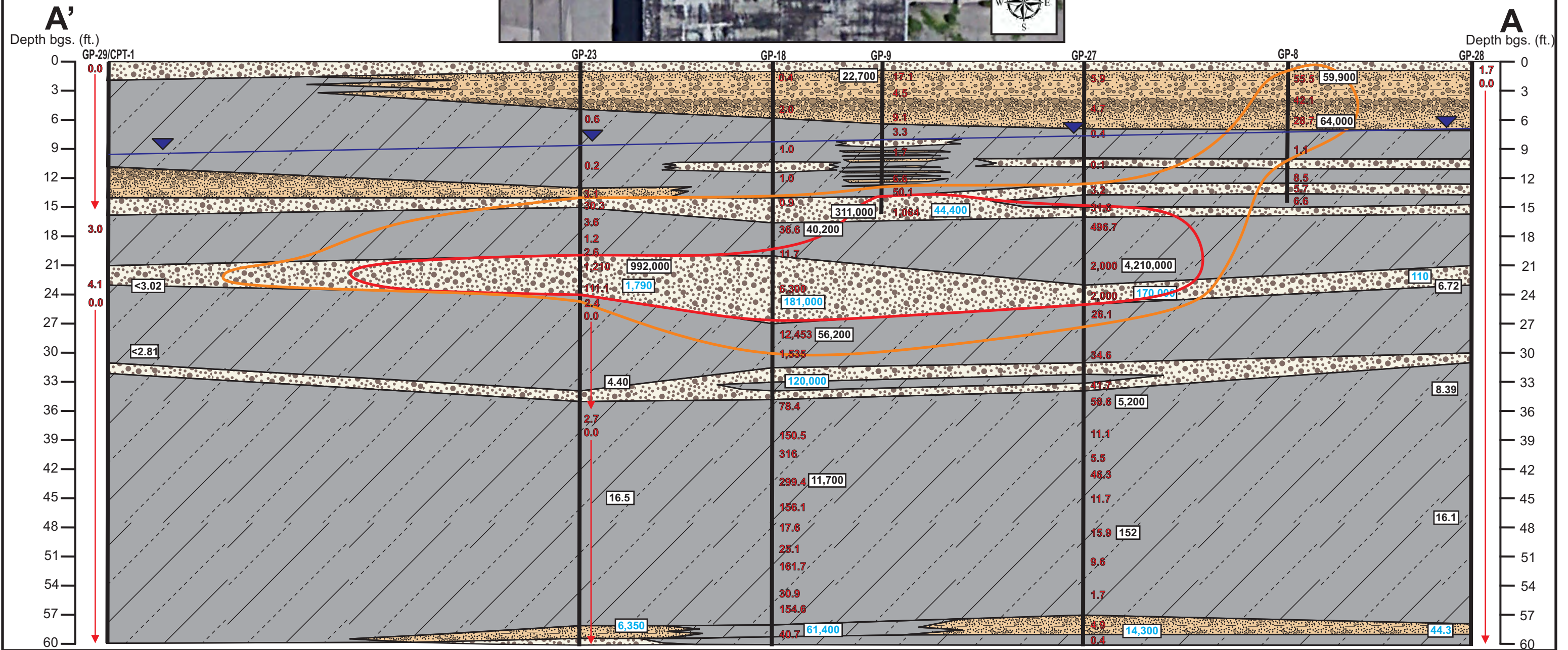
ENVIRONMENTAL

Environmental Science and Engineering

Sample and Monitoring Well Location Map

Former Henries Dry Cleaner
906 South 200 West, Salt Lake City, Utah

PROJECT NO.	DRAWING DATE	FIGURE
2221-003G	August 13, 2020	C-13



XX.X = Photoionization detector reading in parts per million

XX.X Soil PCE concentration in micrograms per kilogram unless otherwise noted

XX.X Groundwater PCE concentration in micrograms per liter

Soil Impacts Above U.S. EPA RSL for PCE in Industrial Soil

Soil Impacts Above U.S. EPA RSL for PCE in Residential Soil

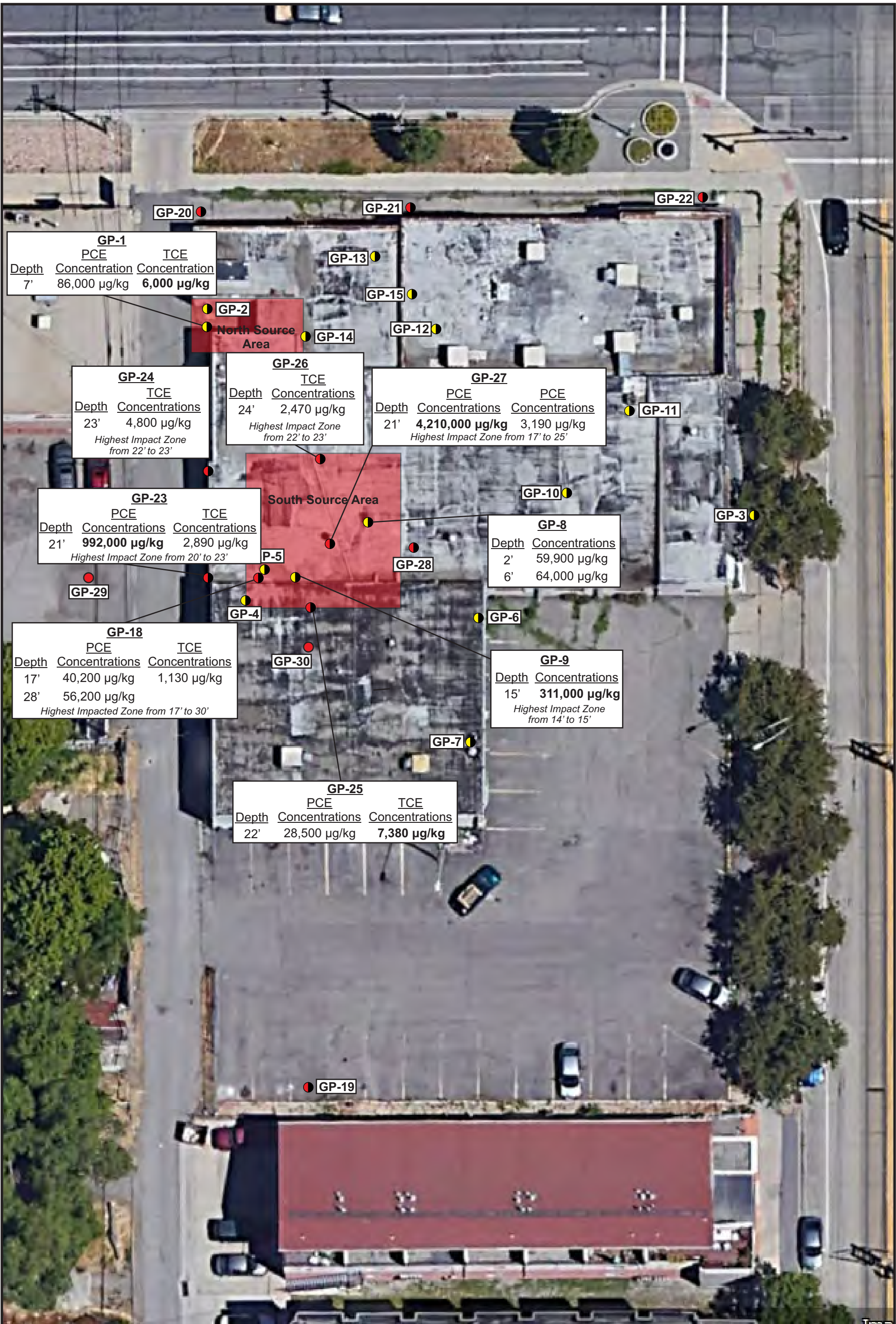
Water table

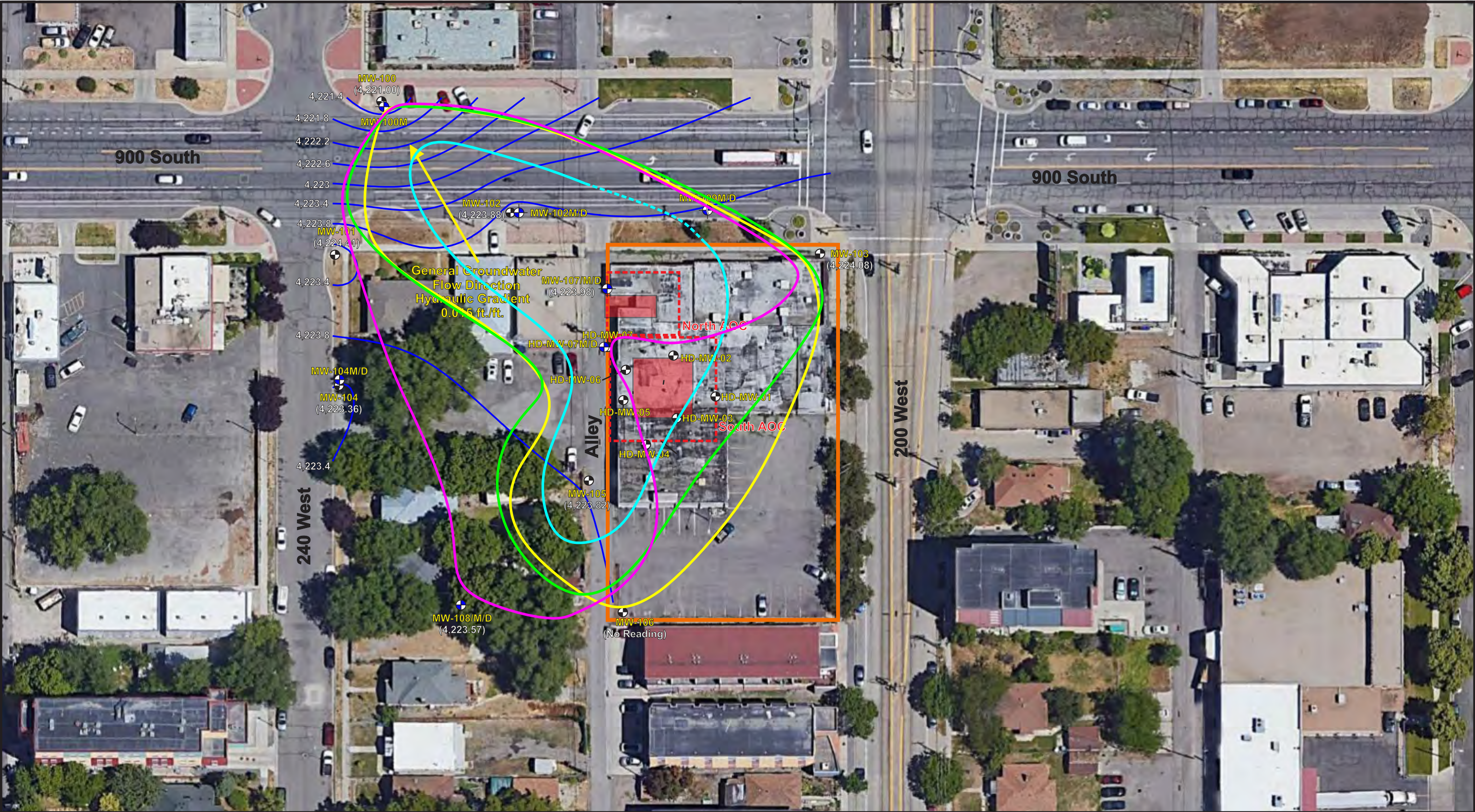
Environmental Science and Engineering

East/West Hydrogeological Cross-Section

Former Henries Dry Cleaner
906 South 200 West
Salt Lake City, Utah

PROJECT NO. 2221-003G	DRAWING DATE August 3, 2020	FIGURE C-14
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AOC Boundaries (North and South)

Site Property Boundary

Source Areas

Weston or AECOM Previously Installed Shallow Monitoring Well

Wasatch Monitoring Well Location

PCE MCL Contour (5 µg/L)

TCE MCL Contour (5 µg/L)

Piezometric Surface (in feet)

VC MCL Contour (2 µg/L)

cis-1,2-DCE MCL Contour (70 µg/L)

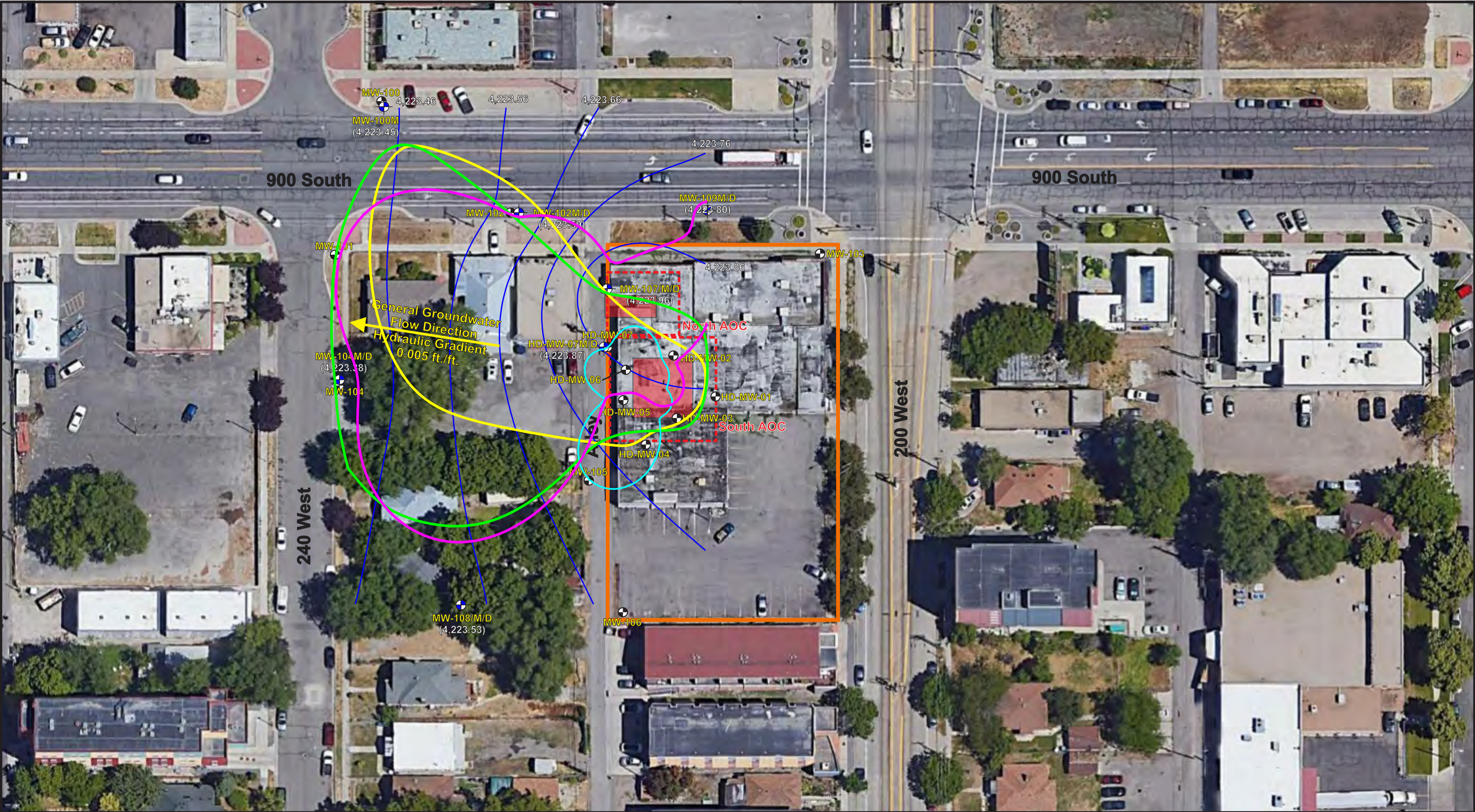
Scale: 1" equals approximately 62'

WASATCH
ENVIRONMENTAL
Environmental Science and Engineering

Shallow Potentiometric Surface and Groundwater Plume Map (June 17, 2020)

Former Henries Dry Cleaner
906 South 200 West, Salt Lake City, Utah

PROJECT NO.	DRAWING DATE	FIGURE
2221-003G	August 10, 2020	C-18



AOC Boundaries (North and South)

Site Property Boundary

Source Areas

Weston or AECOM Previously Installed Shallow Monitoring Well

Wasatch Monitoring Well Location

PCE MCL Contour (5 µg/L)

TCE MCL Contour (5 µg/L)

Piezometric Surface (in feet)

VC MCL Contour (2 µg/L)

cis-1,2-DCE MCL Contour (70 µg/L)

Scale: 1" equals approximately 62'

W

N

E

S

WASATCH

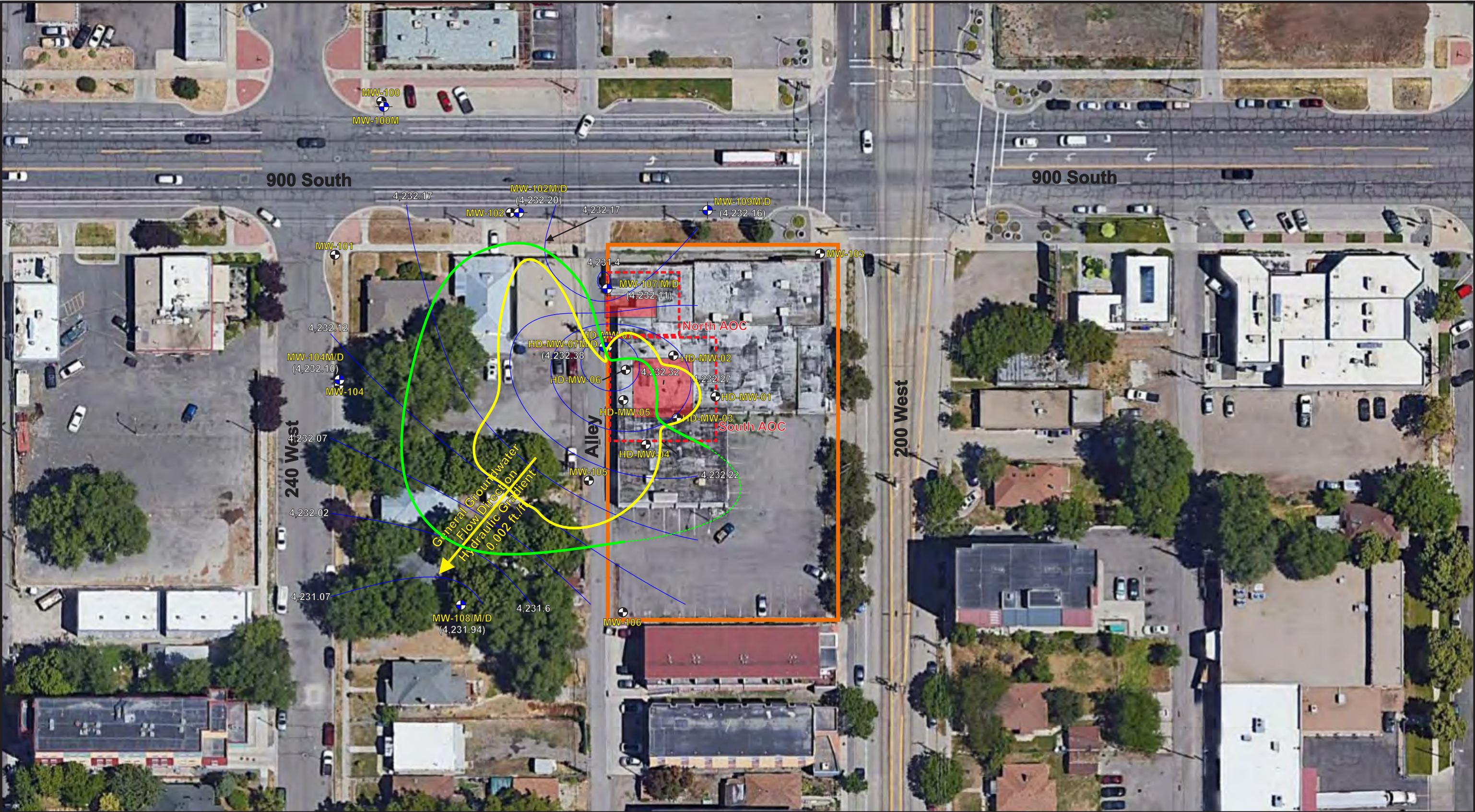
ENVIRONMENTAL

Environmental Science and Engineering

Intermediate Potentiometric Surface and Groundwater Plume Map (June 17, 2020)

Former Henries Dry Cleaner
906 South 200 West, Salt Lake City, Utah

PROJECT NO.	DRAWING DATE	FIGURE
2221-003G	August 10, 2020	C-19



AOC Boundaries (North and South)

Site Property Boundary

Source Areas

Weston or AECOM Previously Installed Shallow Monitoring Well

Wasatch Monitoring Well Location

PCE MCL Contour (5 µg/L)

TCE MCL Contour (5 µg/L)

Piezometric Surface (in feet)

Scale: 1" equals approximately 62'

N

W

E

S

WASATCH

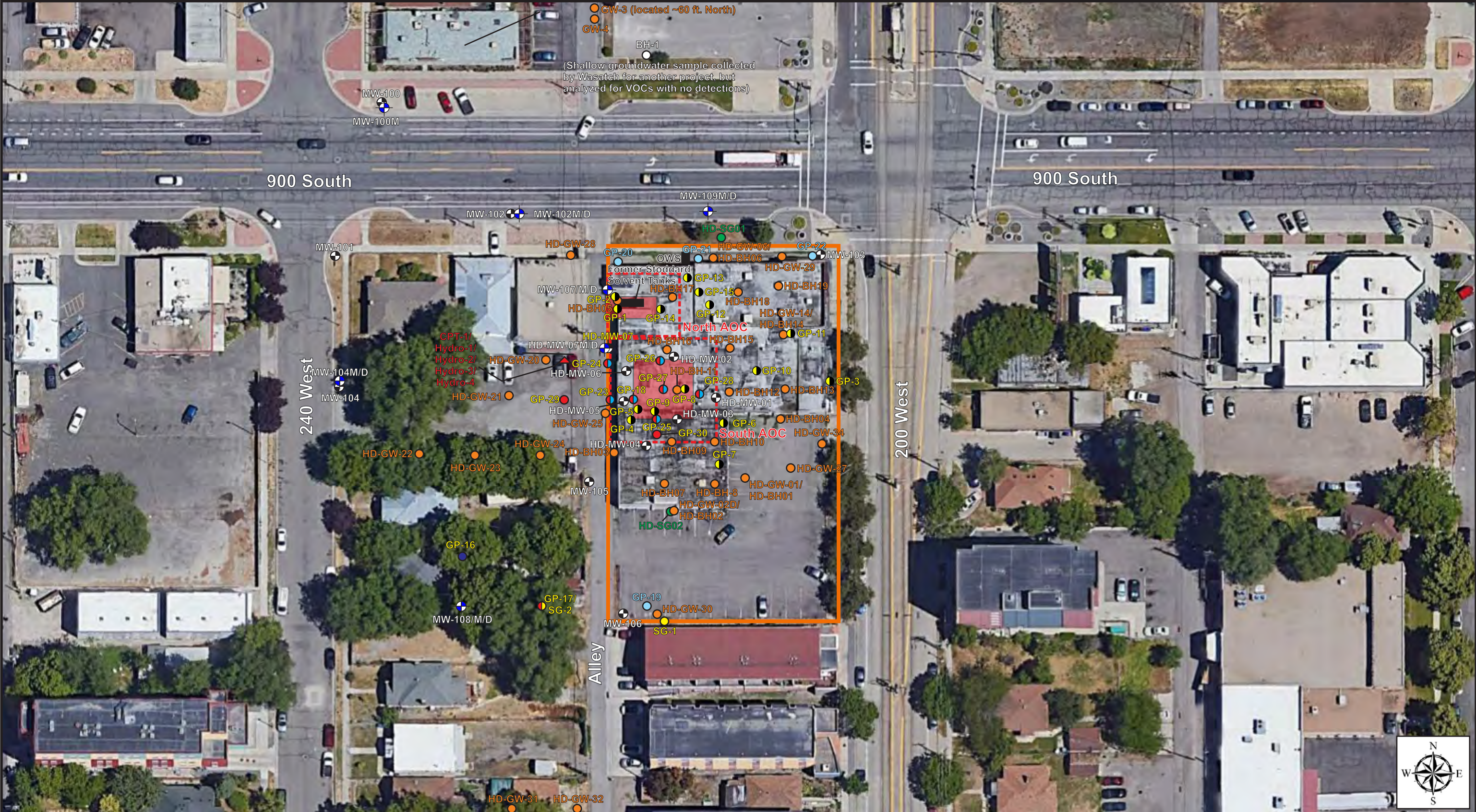
ENVIRONMENTAL

Environmental Science and Engineering

Deep Potentiometric Surface and Groundwater Plume Map (June 17, 2020)

Former Henries Dry Cleaner
906 South 200 West, Salt Lake City, Utah

PROJECT NO.	DRAWING DATE	FIGURE
2221-003G	August 10, 2020	C-20



AOC Boundaries (North and South)

Site Property Boundary

Source Areas

Shallow Monitoring Well (AECOM/Weston)

Clustered Monitoring Well Location (Wasatch)

Subsurface Soil Gas Sample Location

Groundwater Sample Boring Location

Soil Gas (Vapor Implant) and Groundwater Sample Boring Location

60 Foot Deep Soil and Groundwater Sample Boring Location

30 Foot Deep Boring Location (Lithology Only)

Weston Soil Gas Samples

Weston Boring Location

CPT/Hydropuch Sample Location

30 Foot Soil Sample Only Boring

Scale: 1-inch equals approximately 62 feet

WASATCH

ENVIRONMENTAL

Environmental Science and Engineering

Historical Sample Location Map

Former Henries Dry Cleaner
906 South 200 West, Salt Lake City, Utah

PROJECT NO.	DRAWING DATE	FIGURE
2221-003G	August 10, 2020	C-21

APPENDIX D

Corrective Action Plan. 2021. Wasatch Environmental, Inc.

DSHW-2021-000565

Div of Waste Management
and Radiation Control

**CORRECTIVE ACTION PLAN
FORMER HENRIES DRY CLEANER
906 SOUTH 200 WEST
SALT LAKE CITY, UTAH**

JAN 08 2021


Project No. 2221-003G

Prepared for:

**Mr. Ty L. Howard, Director
Utah Department of Environmental Quality
Division of Waste Management and Radiation Control
P.O. Box 144880
Salt Lake City, UT 84114-4880**

Prepared by:

**Wasatch Environmental, Inc.
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**Michael S. Cronin, P.G.
Senior Project Manager and Senior Geologist**

January 8, 2021

**CORRECTIVE ACTION PLAN
FORMER HENRIES DRY CLEANER
906 SOUTH 200 WEST
SALT LAKE CITY, UTAH**

Project No. 2221-003G

Prepared for:

**Mr. Ty L. Howard, Director
Utah Department of Environmental Quality
Division of Waste Management and Radiation Control
P.O. Box 144880
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January 8, 2021

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Appendix E	Standard Operating Procedures

**CORRECTIVE ACTION PLAN
FORMER HENRIES DRY CLEANER
906 SOUTH 200 WEST
SALT LAKE CITY, UTAH**

1. INTRODUCTION

On behalf of Dewey 9th, LLC (Dewey 9th), the owner of the former Henries Dry Cleaner (Facility), Wasatch Environmental, Inc. (Wasatch), has prepared this Corrective Action Plan (CAP) for addressing chlorinated solvent impacts to soil and groundwater that have been identified on-site at the Facility and off-site properties. This CAP has been largely adapted from the Remedial Action Plan (RAP) (Wasatch, 2018e), Quality Assurance Project Plan (QAPP) (Wasatch, 2018d), the Sampling and Analysis Plan (SAP) (Wasatch, 2018f); documents previously prepared for and approved by the Division of Environmental Response and Remediation (DERR) when the Facility was regulated under the Utah Voluntary Cleanup Program (VCP) discussed further in Section 1.2 of this CAP. The CAP is intended to replace the aforementioned documents and is intended for use under the regulatory authority of the Utah Division of Waste Management and Radiation Control (DWMRC).

The owner plans to redevelop the Facility (location is shown on Figure 1) as part of a larger redevelopment project that includes the Facility as well as many of the properties located west of the Facility as shown on Figure 2. For the purposes of this CAP, the term Facility is used to refer to the former Henries Dry Cleaner property the term owner-controlled off-site properties is used to refer to off-site properties that are owned and controlled by the owner and are part of the owner's redevelopment project and the term non-owner-controlled off-site properties refers to off-site properties that are neither owned nor controlled by the owner. The term on-site is used to refer to features or issues located on, or pertaining to, the former Henries Dry Cleaner Facility. The term off-site (in the absence of a prefix denoting owner-controlled or non-owner-controlled) is used to refer to features or issues neither located on, nor pertaining to, the former Henries Dry Cleaner Facility, regardless of whether the feature or issue pertains to a property controlled or owned by the owner. Defining and understanding these terms is critical for discussions related to the remedial strategy. The Facility and owner-controlled off-site properties are clearly illustrated on Figure 2.

1.1 Facility Description

The Facility is located at 906 South 200 West in Salt Lake City, Utah (see Figure 1). The Facility is identified by the Salt Lake County Assessor's Office as Parcel Numbers 15-12-258-015 and 15-12-258-016 and totals 0.85 acres.

The Facility is bordered to the north by 900 South, to the east by 200 West, to the south by multifamily-residential development, to the southwest by vacant single-family residential development, and to the west by an alley and a mix of vacant single-family residential and commercial development beyond the alley (see Figure 3).

The Facility is occupied by one single-story, vacant, former dry cleaning building which occupies 17,150 square feet on the northern portion of the Facility, and asphalt parking on the southern portion of the Facility. The floor of the building consists of concrete in most areas. Offices and a restroom are located in the eastern portion of the building with one additional restroom located in the western portion of the building. A boiler room is located in the northwest portion of the building. Two underground storage tanks (USTs) containing Stoddard solvent were formerly located outside the northwestern portion of the building. The main entrances are located in the northeast portion of the building. Several other entrances are located on the west and east sides of the building. The dry cleaning activities were conducted in three main areas (northern, central, and southern production areas). An oil/water separator (OWS) is located just north of the northern side of the building. Several floor drains are located throughout the building. Facility features are shown on Figure 4 and detailed Facility features are shown on Figure 5.

1.2 Facility Background

Based on the findings of Phase I Environmental Site Assessments (ESAs) (Wasatch, 2018b; Weston, 2016a and 2017b), the dry cleaning building was constructed in several phases beginning in 1919 in the northeast portion of the Facility, and was expanded in 1962 and again in 1971, to its current size and configuration. The building has been occupied by several different dry cleaners for a period of over 90 years. The most recent occupant was Henries Dry Cleaner, which vacated the building in 2015. The Facility was identified as a leaking underground storage tank (LUST) site and a chlorinated solvent hazardous waste generator site. The USTs contained Stoddard solvent (a petroleum-based solvent similar to diesel fuel in composition). The USTs were removed in 1990 and the release reportedly impacted only soil. The impacted soil was excavated and disposed off-site. The 1992 Preliminary Site Cleanup Report by Sitex Environmental, Inc., (Sitex, 1992) documented that some minor residual ethylbenzene and xylene contamination remained following the excavation and off-site disposal of soil contaminated with Stoddard solvent from the UST basin located near the northwest corner of the Facility. The LUST release was granted regulatory closure in 1996.

Granite Environmental, Inc., collected one soil sample during a subsurface investigation conducted in 1999 (Granite, 1999). The soil sample contained tetrachloroethene (PCE) at a concentration of 5.6 micrograms per kilogram ($\mu\text{g/kg}$). Although the concentration of PCE detected was well below the current United States Environmental Protection Agency (U.S. EPA) Regional Screening Levels (RSLs) for both Composite Worker and Residential Soil, this was the first sample collected from the Facility that confirmed a chlorinated solvent release and impacts to environmental media.

In 2015, Environmental Resource Management (ERM) conducted indoor air sampling at the Facility (ERM, 2015). Two of the four indoor air samples collected from the dry cleaner building exceed the U.S. EPA RSL for Industrial Indoor Air for PCE.

Weston Solutions, Inc., (Weston) conducted subsurface investigation work at the Facility in two phases; the first phase was conducted in 2016 (Weston, 2016b), and the second phase was conducted in 2017 (Weston, 2017a). The results of the 2016 subsurface investigation work demonstrated that halogenated volatile organic compound (VOC) concentrations including: 1,1-dichloroethene (1,1-DCE), *cis*-1,2-dichloroethene (*cis*-1,2-DCE), PCE, trichloroethene (TCE), and vinyl chloride (VC) in groundwater exceeded the U.S. EPA Maximum Contaminant Levels (MCLs) in the west-central portion of the Facility. Six soil borings were advanced around the building exterior. Two soil samples were collected from each boring. One soil sample was also collected of the sludge found in each of the two interior sumps. Benzo(a)pyrene was detected at a concentration exceeding the U.S. EPA RSL for Residential Soil in one sample located near the former Stoddard solvent UST basin. Total Petroleum Hydrocarbons as Diesel-Range Organics (TPH-DRO) and Total Petroleum Hydrocarbons as Gasoline-Range Organics (TPH-GRO) exceeded the Utah Initial Screening Levels (ISLs) in the sample collected from the north sump. Arsenic exceeded the U.S. EPA RSL for Industrial Soil in the samples collected from the north sump and the south sump. The arsenic concentrations are within the range of typical background arsenic concentrations for Utah. The investigation also demonstrated that chlorinated solvent concentrations in soil gas exceeded the U.S. EPA Residential Vapor Intrusion Screening Levels (VISLs) in two sample locations; one soil gas sample was collected from a location adjacent to the north-central portion of the building, and one soil gas sample was collected from a location adjacent to the south-central portion of the building. No source areas for the chlorinated solvent contamination at the Facility were identified at that time.

The second phase of subsurface investigation by Weston demonstrated that chlorinated solvent (primarily PCE, TCE, *cis*-1,2-DCE, and VC) concentrations in shallow groundwater exceeding the U.S. EPA MCLs were present throughout most of the Facility and extended off-site to the northwest, west, and southwest. This investigation effort failed to delineate the off-site extent of the shallow groundwater plume. Although low concentrations (below U.S. EPA RSLs for Residential Soil) of chlorinated solvents were detected in soil at sampled locations throughout much of the Facility, the investigation failed to identify the source areas for the chlorinated solvent contamination at the Facility.

AECOM Technical Services, Inc. (AECOM), conducted additional subsurface investigation in 2017 intended to define the lateral extent of the shallow groundwater plume (AECOM, 2018). The investigation involved the advancement of seven soil borings, all of which were converted to groundwater monitoring wells (MW-100 through MW-106). The soil borings and monitoring wells were installed in locations intended to delineate the lateral extent of the shallow groundwater plume. The investigation successfully delineated the shallow groundwater plume in every direction except to the southwest. The investigation determined that the shallow groundwater gradient was primarily to the northwest, and that the groundwater plume extended off-site to the southwest, west, and northwest. The investigation determined that the shallow groundwater plume primarily extends in a northwesterly direction and does not reach the north side of 900 South. No analytes were detected in soil at concentrations exceeding the U.S. EPA RSLs for either Residential or Composite Worker Soil.

Wasatch conducted a survey of the building interior and sewer lines in 2018 to identify potential source areas (i.e., staining, cracks and joints in the floor slab, breaks in the sewer lines, locations of dry cleaning equipment, drum storage areas, floor drains, etc.) that may have served as sources or pathways for PCE to be released to the subsurface (Wasatch, 2018a). These features were carefully mapped, along with the location of prior sampling locations. The detailed Facility features are shown on Figure 5. This information was then used to formulate a strategy for a subsequent subsurface investigation intended to locate the source areas for the chlorinated solvent contamination in groundwater.

Later in 2018, Wasatch conducted a subsurface investigation targeted at identifying locations that may have served as sources or pathways for PCE to be released to the subsurface (Wasatch, 2018c). Fifteen soil borings were advanced in the potential source areas. Soil samples were collected from each of the borings and groundwater samples were collected from eight of the borings. The investigation successfully identified two source areas for the chlorinated solvent contamination in groundwater. A smaller source area was identified in association with the Stoddard solvent UST basin located near the northwest corner of the building, and a larger source area was identified in association with a drum storage area and dry cleaning equipment located near the west-central portion of the building.

An application to enter the Facility into the Utah VCP was submitted on August 9, 2018. The Facility was formally accepted into the VCP on September 26, 2018; and was designated VCP Site C096. Following acceptance into the VCP; Wasatch prepared and submitted a QAPP (Wasatch, 2018d), a RAP (Wasatch, 2018e), a SAP (Wasatch, 2018f), and a Work Plan for Additional Site Characterization (Wasatch, 2018g). Each of these documents was subsequently approved by the Utah DERR.

Wasatch executed two phases of additional site characterization work during 2019. The first phase was conducted in January under the Work Plan for Additional Site Characterization (Wasatch, 2018g). The second phase was conducted in February under the Work Plan Addendum for Additional Site Characterization (Wasatch 2019a). The results of both phases of investigation were reported in the Additional Site Characterization Report (Wasatch, 2019c).

The first phase of additional site characterization conducted during 2019 was completed on January 10, 2019. The site characterization activities included advancing three soil borings using direct-push drilling techniques. Two soil borings (GP-16 and GP-17) were completed to depths of 15 feet below ground surface (bgs) and were located on the southwest adjoining residential properties to evaluate off-site groundwater and soil gas concentrations. No soil samples were collected from these borings. The third boring (GP-18) was completed using dual-tube direct-push drilling techniques within the south source area. This boring was advanced to a depth of 60 feet bgs to facilitate the collection of four soil samples and three discrete groundwater samples.

The second phase of additional site characterization conducted during 2019 was completed between February 19 and 28, 2019. The site characterization activities included advancing 10 soil borings using direct-push drilling techniques. Four soil borings (GP-19 through GP-22) were advanced to evaluate the top and bottom of a known flowing sand lens present at the Facility. No environmental samples were collected from these borings. Additionally, six soil borings (GP-23 through GP-28) were advanced to a

depth of 60 feet bgs using dual-tube direct-push drilling techniques and were completed within the south source zone to better define the lateral extent of chlorinated solvent impacts to soil in this area. Three soil samples and two discrete groundwater samples were collected from each of these soil borings. Wasatch also supervised the installation of three intermediate (MW-102M, MW-104M, HD-MW-07M) and three deep (MW-102D, MW-104D, HD-MW-07D) groundwater monitoring wells. These wells were installed to better evaluate the fate and transport of dissolved phase chlorinated solvent impacts at the Facility at multiple depths.

Data collected during the 2019 additional site characterization served to improve the delineation of the vertical and lateral extent of soil impacts in the south source area, delineate the southwestern portion of the shallow groundwater plume, and improve our understanding of the extent and degree of contamination in the intermediate and deep groundwater zones. The soil gas samples collected during the 2019 additional site characterization established that there was no vapor intrusion risk identified immediately south and southwest of the Facility. Soil borings advanced during the 2019 additional site characterization also established that the depth to the top and bottom of the flowing sand layer identified at the Facility is fairly consistent; with the depth to the top of the unit ranging from 20 to 21 feet bgs, and depth to the bottom of the unit ranging from 24 to 27 feet bgs. The results of the investigation were reported in the Additional Site Characterization Report (Wasatch, 2019c). The findings of the 2019 additional site characterization work were also addressed, and appropriate adjustments to the remedial approach were presented, in the Addendum to the RAP (Wasatch, 2019b).

During 2019, subsequent to the submittal of the Additional Site Characterization Report (Wasatch, 2019c) and the Addendum to the RAP (Wasatch, 2019b), the Facility was transitioned from the Utah DERR VCP to the Utah DWMRC for regulatory oversight. The Utah DWMRC was provided with copies of all of the relevant reports and documentation for the Facility and was provided with an opportunity to review and comment on the existing documentation. The Utah DWMRC provided written comments to Wasatch on November 25, 2019. Wasatch provided a written response to the Utah DWMRC comments on February 28, 2020.

Wasatch submitted a Work Plan for Additional Site Characterization (Wasatch, 2020a) to the Utah DWMRC which presented a proposed approach for addressing the remaining site characterization issues as presented in the Utah DWMRC written comments and Wasatch's response to comments. The work plan was approved by the Utah DWMRC on April 7, 2020.

Wasatch completed the additional site characterization work during May and June of 2020; and the results were reported to the DWMRC on September 4, 2020 (Wasatch, 2020b). Soil samples collected from borings GP-29, located to the west of the south source area, and GP-30, located to the south of the south source area, exhibited no analyte concentrations in excess of the U.S. EPA RSLs for Residential Soil. The south source area has now been completely defined with respect to the lateral extent of soil impacts exceeding applicable U.S. EPA RSLs. Our conceptualization of the lateral extent of soil impacts exceeding the U.S. EPA RSLs has not changed from what was previously addressed in the RAP (Wasatch, 2018e).

Wasatch completed research regarding the potential presence, construction details, and use of nearby water wells. Based on Wasatch's research, six water wells (not including monitoring wells) are located within 0.32 miles to 0.75 miles of the Facility. Based on the current status of each well, well construction data, and the distance from the Facility; it is our opinion that these wells are not likely to be impacted and would not likely be impacted in the future.

Monitoring wells MW-107 and MW-108 were installed to facilitate further evaluation of the shallow groundwater zone. Monitoring well MW-107 is located along the central axis of the shallow groundwater plume, downgradient of the north and south source areas. MW-107 exhibited concentrations of PCE and *cis*-1,2-DCE in excess of the U.S. EPA MCLs; and detectable concentrations (but below applicable U.S. EPA MCLs) of *trans*-1,2-DCE, TCE, and VC. Monitoring well MW-108 is located off-site to the west of the southwest corner of the Facility and, along with monitoring well MW-106, serves to delineate the southern edge of the shallow groundwater plume. Monitoring well MW-108 exhibited a detectable (but below U.S.

EPA MCL) concentration of *cis*-1,2-DCE. No other analytes were detected in the groundwater sample collected from monitoring well MW-108. The hydraulic gradient in the shallow groundwater zone is to the northwest at 0.015 ft/ft.

Monitoring wells MW-100M, MW-107M, MW-108M, and MW-109M were installed to facilitate further evaluation of the intermediate groundwater zone. Monitoring wells MW-100M, MW-107M, and MW-109M are located along the northern edge of the intermediate groundwater plume. No analytes were detected in the groundwater sample collected from monitoring well MW-100M. Groundwater samples collected from monitoring wells MW-107M and MW-109M exhibited *cis*-1,2-DCE concentrations in excess on the MCL, and a detectable (but below MCL) concentration of *trans*-1,2-DCE. MW-108M is located off-site to the west of the southwest corner of the Facility and serves to delineate the southern edge of the intermediate groundwater plume. No analytes were detected in the groundwater sample collected from monitoring well MW-108M. The hydraulic gradient in the intermediate groundwater zone is to the west-northwest at 0.005 ft/ft, with an upward vertical hydraulic gradient from the intermediate to shallow aquifers.

Monitoring wells MW-107D, MW-108D, and MW-109D were installed to facilitate further evaluation of the deep groundwater zone. Monitoring wells MW-107D and MW-109D are located along the northern edge of the deep groundwater plume. No analytes were detected in the groundwater sample collected from monitoring well MW-107D. The groundwater sample collected from monitoring well MW-109D exhibited detectable (but below applicable U.S. EPA MCL) concentrations of *cis*-1,2-DCE and *trans*-1,2-DCE. MW-108D is located off-site to the west of the southwest corner of the Facility and serves to delineate the southern edge (downgradient) of the deep groundwater plume. No analytes were detected in the groundwater sample collected from monitoring well MW-108D. The hydraulic gradient in the deep groundwater zone is to the southwest at 0.002 ft/ft, with an upward vertical hydraulic gradient.

The hydraulic gradient for each groundwater zone discussed above (shallow, intermediate, and deep groundwater zones); appears to comport with the geometry of the groundwater plume for each zone.

Cone penetration test (CPT) boring CPT-1 (and associated hydropunch borings for groundwater samples) was advanced to a depth of 102 feet in a location west of the south source area to facilitate the collection of groundwater samples from depths greater than 60 feet (the depth to which investigations were previously limited) to define the vertical extent of groundwater impacts at the Facility. The CPT boring also provided data related to the stratigraphy beneath the Facility at depths below 60 feet. The CPT data indicate the presence of transport zones at depths of 13 to 16 feet, 20 to 22 feet, 29 to 32 feet, 58 to 76 feet, 86 to 88 feet, and 100 to 102 feet. Groundwater samples Hydro-4 (from 68 to 71 feet), Hydro-3 (from 75 to 78 feet), Hydro-2 and a duplicate sample Hydro-20 (from 85 to 88 feet), and Hydro-1 (from 100 to 103 feet) were collected from the hydropunch borings. The laboratory analytical results from these groundwater samples indicate that groundwater contamination at concentrations in excess of the applicable U.S. EPA MCLs has reached a maximum depth of 88 feet.

Field observations and laboratory analytical data (dissolved phase concentrations exceeding 1% of the aqueous solubility of PCE, or 2,000 ug/L) indicate that DNAPL is likely not present at the Facility below a depth of 60 feet.

The extent and degree of impacts to soil at the Facility; and to the shallow (wells screened from 5 to 15 feet), intermediate (wells screened from 20 to 30 feet), and deep (wells screened from 50 to 60 feet) groundwater zones; have been defined. The maximum depth of impacts to soil exceeding the U.S. EPA RSLs and to groundwater exceeding the U.S. EPA MCLs at the Facility have also been determined. The very deep groundwater zone (the transport zone sampled by Hydro-2 and duplicate sample Hydro-20 at approximately 85-88 feet) exhibits moderate impacts that are likely attributable in part to sample turbidity. While the lateral extent of impacts in the very deep groundwater zone are not delineated, there do not appear to be any complete exposure pathways, the lateral extent is likely very limited (based on the analyte concentrations detected in the groundwater samples collected from this zone), and active remediation is not feasible from a cost perspective. Therefore, Wasatch contended that remediation of the Facility should proceed concurrently with, or prior to, further investigation or monitoring of the very

deep groundwater zone (wells would likely be screened from 80 to 90 feet), to the extent that any such monitoring is necessary.

The Additional Site Characterization Report dated September 4, 2020 (Wasatch, 2020b), provides a full evaluation of the environmental conditions at the Facility based on the entire data set for the Facility (including current data tables, plume maps, and cross-sections), as well as providing historical data tables and historical sample location maps. Wasatch, 2020b, should be used as a companion document to this CAP.

1.3 Objectives

The owner plans to redevelop the Facility as part of a larger redevelopment project that also includes the owner-controlled off-site properties located west of the Facility as shown on Figure 2. This provides the owner with the opportunity to manage off-site impacts to the west of the Facility and eliminate potential routes of exposure through the implementation of engineering and institutional controls. Redevelopment of the Facility and owner-controlled off-site properties would include ground-level parking structures and limited commercial space (primarily along 900 South) and residential space on levels 2 through 4 above the on-grade parking and commercial spaces. The owner would identify non-owner-controlled off-site properties having structures in areas where there may be a risk of vapor intrusion attributable to releases from the Facility, screen these properties and structures against residential standards, and implement appropriate vapor mitigation measures as required (with the permission of the off-site property owners).

The owner intends to demolish and remove the existing structures located on-site and on owner-controlled off-site properties and redevelop the Facility and owner-controlled off-site properties with parking and commercial use on the ground floor and residential above the ground floor. Therefore, the objective of this corrective action is to remediate soil at the Facility to meet the U.S. EPA RSLs for Composite Worker Soil, and site-specific cleanup levels developed as an outcome of the Human Health Risk Assessment (HHRA) for groundwater.

The owner also intends to mitigate residual vapor intrusion risk that may remain at the Facility, and at owner-controlled off-site properties, following active remediation to meet U.S. EPA RSLs for Industrial Indoor Air on the ground floor and U.S. EPA RSLs for Residential Indoor Air above the ground floor. The owner anticipates that land use and engineering controls (which would require an Environmental Covenant [EC] and Site Management Plan [SMP]) would be a required component for achieving regulatory closure of the Facility. The land use and engineering controls would likely be necessary, both for the Facility and owner-controlled off-site properties, due to the probability that the U.S. EPA MCLs and/or VISL Commercial Target Groundwater Concentrations may not be achieved in the short-term. Therefore, the owner anticipates that long-term groundwater monitoring, restrictions on the use of groundwater, restrictions on land use and development, and engineering controls (i.e., vapor barrier and/or sub-slab depressurization system, etc.) would be required to ensure that chlorinated solvent concentrations in indoor air are maintained at acceptable levels following active remediation and redevelopment. Engineering controls, such as vapor mitigation systems, will be made available if necessary to manage exposure risks at some non-owner-controlled off-site properties. Remediation of the Facility can only realistically occur with prompt redevelopment, using engineering controls and in accordance with land use restrictions, upon completion of active remediation; otherwise funds for remediation are not available.

1.4 Conceptual Site Model

The Facility is located within the discharge area for the basin-fill aquifer system, near the eastern boundary of the secondary recharge area. The discharge area of the basin-fill aquifer system is characterized by a shallow unconfined aquifer overlying a deep confined aquifer, with a confining layer (aquitard) separating the shallow unconfined aquifer from the deep confined aquifer. The discharge area exhibits an upward vertical hydraulic gradient (Wallace and Lowe, 2009).

The shallow unconfined aquifer, where it is present, extends to a maximum depth of approximately 50 feet and is composed primarily of clays, silts, and fine-grained sands. Throughout the central portion of Salt Lake Valley, the shallow unconfined aquifer has an upward vertical hydraulic gradient. Recharge to the shallow unconfined aquifer generally occurs through infiltration of precipitation falling on the valley floor, infiltration of unconsumed irrigation water, and upward migration of groundwater through the confining layer from the deep confined aquifer. Discharge from the shallow unconfined aquifer is generally to the Jordan River, streams, canals, springs, the Great Salt Lake, and loss through evapotranspiration. The shallow unconfined aquifer is only slightly more permeable than the confining layer which underlies the shallow unconfined aquifer, yields little water, the water is of poor quality, and; therefore, is rarely used as a source of potable water (Wallace and Lowe, 2009).

The confining layer, where it is present, ranges from 40 to 100 feet thick and is composed of Quaternary deposits of clay, silt, and fine-grained sands. The confining layer exhibits an estimated average upward vertical hydraulic conductivity of 0.025 feet per day (Wallace and Lowe, 2009).

The deep confined aquifer ranges from 0 feet (at the edges of the valley where it becomes unconfined and in the recharge area) to over 2,000 feet in thickness and is composed of layered Quaternary deposits of clay, silt, sand, and gravel which are hydraulically interconnected. The deep confined aquifer has an upward vertical hydraulic gradient. Recharge to the deep confined aquifer generally occurs through inflow from consolidated rock and coarse-grained unconsolidated sediments in the primary and secondary recharge zones (along the margins of the valley); and infiltration from streams, rivers, canals, ponds, and lakes where the water level elevation is higher than the water table (i.e., losing streams, etc.). Groundwater flow originates in the recharge areas to the northern and central portions of Salt Lake Valley. Discharge from the deep confined aquifer is through groundwater withdrawal from wells, and upward movement through the confining layer to the shallow aquifer. In the central portion of the Salt Lake Valley (including the area in which the Facility is located), the deep confined aquifer is classified as a Class II aquifer, suitable for use as drinking water. The deep confined aquifer is the principal aquifer from which most of the groundwater from the Salt Lake Valley is discharged (i.e., for irrigation, stock watering, potable water, etc.) (Wallace and Lowe, 2009).

Soils at the Facility consist of sand fill (SW), sandy silt (ML), and silty clay (CL); overlying silty sand/sandy silt (SM/ML ML/SM), sand (SP), and gravelly sand (SW). Soils consisting primarily silts and clays are likely to serve primarily as contaminant storage zones, while the sand and gravel units serve as contaminant transport zones.

Two source areas have been identified which Wasatch believes are the primary source of dissolved phase groundwater contamination: a smaller source area (the north source area) associated with the former Stoddard solvent tank area, and a larger source area (the south source area) associated with a drum storage area and dry cleaning equipment located in the central production area. While there are no data collected from the north source area to suggest the presence of DNAPL in that location, DNAPL released in the south source area sank into the subsurface to a maximum depth of approximately 60 feet bgs impacting four groundwater zones (designated the shallow, intermediate, deep, and very deep groundwater zones) to varying degrees. Groundwater exhibiting chlorinated solvent concentrations in excess of the U.S. EPA MCLs does not appear to extend below a depth of approximately 88 feet at the Facility.

Depth to groundwater for the shallow aquifer is approximately 6 to 8 feet bgs. Based upon the most recent field measurements, the hydraulic gradient for the shallow aquifer is generally to the northwest at approximately 0.015 ft/ft. Groundwater and contaminant transport within the shallow aquifer are likely to occur primarily within the sandy soils which typically occur below a depth of approximately 10 feet bgs. Monitoring wells for the shallow aquifer are typically screened from approximately 5 to 15 feet bgs. Dissolved phase chlorinated solvent contamination in shallow groundwater underlies nearly the entire building and much of the remainder of the Facility. The shallow chlorinated solvent plume extends off-site approximately 145 feet to the northwest but does not extend as far as the north side of 900 South Street. The piezometric surface of the shallow aquifer exhibits a slight ridge, located due west of the south source area, which is likely due to a higher rate of groundwater recharge occurring in this area which is

occupied by a deteriorating parking lot, compared to the surrounding land which is largely covered by buildings. The groundwater ridge appears to have caused the shallow dissolved phase plume to bifurcate into a northwest trending lobe (primary lobe) and a southwest trending lobe (secondary lobe). The widespread dissolved phase chlorinated solvent contamination in the shallow aquifer is likely due to a number of factors including: wide-spread chlorinated solvent impacts to soil at concentrations below the U.S. EPA RSLs for Residential Soils, but above the U.S. EPA MCL-based Soil Screening Levels (SSLs), partitioning into groundwater; a relatively flat but variable hydraulic gradient; and diffusion from the source areas.

The lateral hydraulic gradient in the intermediate groundwater zone is to the west-northwest at 0.005 ft/ft, with an upward vertical hydraulic gradient from the intermediate to shallow aquifers. Monitoring wells installed in the intermediate groundwater zone are typically screened from approximately 20 to 30 feet bgs. Chlorinated solvent contamination in the intermediate groundwater zone (including PCE, TCE, *cis*-1,2-DCE, and VC) extends to the north as far as 900 South and to the West as far as 240 West.

The lateral hydraulic gradient in the deep groundwater zone is to the southwest at 0.002 ft/ft, with an upward vertical hydraulic gradient. Monitoring wells installed in the deep groundwater zone are typically screened from approximately 50 to 60 feet bgs. Chlorinated solvent contamination in the deep groundwater zone, consisting of primarily PCE and TCE, extends approximately 140 feet to the southwest.

The hydraulic gradient and lateral extent of impacts in the very deep groundwater zone have not been determined. Given the hydrogeologic setting, Wasatch anticipates that the lateral extent of impacts in this zone will be minimal, and the very deep groundwater zone should exhibit a westerly lateral hydraulic gradient and an upward vertical hydraulic gradient. No monitoring wells have been installed to depths reaching the very deep groundwater zone. Monitoring wells for the very deep groundwater zone wells would likely be screened from 80 to 90 feet. Groundwater exhibiting chlorinated solvent contamination at concentrations in excess of the U.S. EPA MCLs does not appear to extend below a depth of 100 feet bgs.

Vapor intrusion risks associated with the release(s) from the Facility would be driven predominantly by chlorinated solvent impacts to on-site vadose zone soil and dissolved phase impacts to the groundwater in the shallow aquifer.

A complete range of PCE daughter products (including TCE, 1,1-DCE, *cis*-1,2-DCE, *trans*-1,2-DCE, and VC) have been detected in groundwater at the Facility. The presence of these compounds indicates that the PCE is naturally degrading in the environment due to reductive dechlorination.

Based on the current status of water wells (excluding monitoring wells), well construction data, and the distance from the Facility; water wells in the vicinity of the Facility are not likely to be impacted and would not likely be impacted in the future.

2. Risk Assessment

A human health risk assessment (HHRA) and ecological risk waiver will be presented under a separate cover. The HHRA will present site-specific cleanup levels for environmental media impacted by the release(s) from the Facility. The HHRA will evaluate cumulative risk related to the contamination present at the Facility prior to remediation, as well as present a plan for reassessing the cumulative risk following remediation.

3. CORRECTIVE ACTION SELECTION

3.1 Contaminants of Concern

Contaminants of concern include the chlorinated solvent PCE; and PCE daughter products including: TCE, 1,1-DCE, 1,2-*cis*-DCE, 1,2-*trans*-DCE, and VC. Additionally, benzo(a)pyrene is a contaminant of concern with respect to the north source area and possibly the north sump and OWS; and TPH-GRO and TPH-DRO are contaminants of concern with respect to the contents, and possibly the surrounding soils, with respect to the north sump. Consistent with the Utah DWMRC programmatic requirements, future evaluation of total petroleum hydrocarbons as gasoline-range organics (TPH-GRO) and total petroleum hydrocarbons as diesel-range organics (TPH-DRO) will be based on laboratory analysis of VOCs and PAHs and/or SVOCs as discussed in more detail in Section 7 of this CAP.

3.2 Proposed Cleanup Levels

The proposed cleanup levels for soil at the Facility are the U.S. EPA RSLs for Composite Worker Soil. Site-specific cleanup levels for groundwater will be developed as an aspect of the HHRA. The cleanup levels will be protective of human health and the environment, and appropriate for anticipated future use of the Facility and owner-controlled off-site properties.

3.3 Proposed Corrective Action Measures

Given the Facility characteristics, nature and distribution of contaminants, and proposed future land use; Wasatch proposes *in situ* chemical reduction (ISCR) of the contaminants in the saturated zone within the two source areas by injection of a zero valent iron (ZVI) slurry into the two source areas. Vadose zone soils within the two source areas would be remediated by *in situ* mixing of ZVI slurry with the vadose zone soils. Permeable reactive barriers (PRBs) would be installed along the north and west sides of the Facility, and a portion of the south side of the Facility (at the southwest corner of the Facility). The PRBs would reduce the concentrations of dissolved phase contaminants in groundwater as the groundwater migrates off-site. This approach would significantly reduce the contaminant mass remaining in the two source areas (in both the vadose zone and saturated zone), thereby significantly reducing the contaminant mass that is available to partition into groundwater and soil gas. This approach also treats contaminated groundwater as it migrates off-site, significantly reducing the risks associated with off-site groundwater contamination and associated vapor intrusion concerns. Natural attenuation is proposed for groundwater below a depth of 60 feet. Details regarding these remedial action measures are provided in Section 4 of this CAP.

Where ZVI and water make direct contact with PCE and PCE daughter products, the ZVI acts as an electron donor and the chlorinated molecule acts as an electron acceptor. Dechlorination is essentially instantaneous and complete; resulting in ethane and free chloride ions (which tend to bind with metals and form insoluble salts) as end products (Wiedemeier, et. al., 1999).

Where ZVI and water fail to make direct contact with PCE and PCE daughter products, the reducing groundwater conditions resulting from the injection of ZVI fosters anerobic dechlorination through biological pathways. Biological dechlorination is a comparatively slow process that may take years to complete. While the end products are the same as those described above, PCE daughter products (i.e., TCE, *cis*-1,2-DCE, *trans*-1,2-DCE, 1,1-DCE, and VC) are generated as dechlorination progressively removes chloride ions from the chlorinated solvent molecules. VC is the slowest of the PCE daughter products to dechlorinate under anerobic conditions and may briefly accumulate (Wiedemeier, et. al., 1999).

3.4 Proposed Engineering and Institutional Controls

The following engineering and institutional controls are proposed in the event that the remedial action fails to fully achieve the proposed cleanup levels and to manage residual exposure risks following remedial action. Wasatch and the owner understand that cumulative excess cancer risk must be within the 1×10^{-4}

range following completion of active remediation before engineering and institution controls may be used to address the residual risk.

3.4.1 Vapor Barrier and Vapor Mitigation System

Wasatch proposes that a vapor barrier and passive vapor mitigation system (VMS) be installed in the new on-site structure, and a vapor barrier be installed in the new owner-controlled off-site structures. These engineering controls would greatly reduce the potential for vapor intrusion into the new structure. Details regarding these engineering controls are provided in Section 4 of this CAP.

3.4.2 EC and SMP

Wasatch anticipates that groundwater on-site and off-site may not meet the cleanup levels for an indeterminate period of time following active remediation at the Facility, and that residual chlorinated solvent concentrations in groundwater and soil may be sufficient to result in elevated chlorinated solvent concentrations in soil gas and an increased risk of vapor intrusion. An EC and SMP would be implemented to reduce the probability of exposure to the contaminants by specifying how the Facility and owner-controlled off-site properties may and may not be used (e.g., forbidding the extraction and use of shallow groundwater and requiring vapor barriers for new structures and possible VMSs). These controls would be protective of occupants of the Facility and owner-controlled off-site properties and could facilitate regulatory closure of the Facility with residual soil and/or groundwater contamination left in place. The EC and SMP would be subject to review and approval by the Utah DWMRC, as well as a 30-day public comment period.

4. CORRECTIVE ACTION DESIGN AND CONSTRUCTION

Prior to commencement of active remediation at the Facility, all drummed dry cleaning and investigation derived waste would be properly disposed and the contents of the two sumps and OWS would be removed and properly disposed. The two sumps and OWS, and associated pipes, would be removed and properly disposed during later phases of demolition. The locations of these features are shown on Figures 4, 5, and 6.

Details of the remedial design (i.e., excavation boundaries and depths, boring locations, injection depth, ZVI dosing, etc.) may be subject to revision based on unforeseen site conditions and the results of any additional site characterization work that may be performed. Any substantive revisions to the approved CAP would be submitted in writing to the Utah DWMRC prior to implementation of the revision and would be subject to the Utah DWMRC review and approval. Critical aspects of the remedial design are illustrated on Figure 6.

Prior to commencement of the remediation work at the Facility, the above ground portions of the former dry cleaner building would be demolished and removed from the Facility, leaving behind the concrete floor slabs and asphalt pavement. Leaving the floor slabs and pavement in place during the injections and soil mixing would help maintain a cleaner work area and help to form a surface seal during the ZVI injections. Where injections are performed within the footprint of the existing structure and asphalt-paved areas, holes would be cored through the concrete and asphalt to facilitate drilling and injection. The holes would not need to be patched with cement following completion of the injections at each boring location. Because the drill rig and excavator would be tracking over paved surfaces, there should be no need for track-out pads or decontamination of heavy equipment except for the drill-rods, excavator arm, and excavator bucket.

The ZVI product specified for this project is Micro Blend ZVI which will be supplied by CERES Corporation (CERES). The ZVI specifications and material safety data sheet are presented in Appendix A. The ZVI product would be emplaced for the PRBs and treatments of the saturated zone within the two source

areas using specialized hydraulic fracturing and injection tooling by Frac Rite Remediation, Inc., (Frac Rite) using direct-push drilling equipment operated by Direct Push Services (DPS), and with oversight by Wasatch. The procedures and equipment used for the ZVI injections for the PRBs and treatment of the saturated zone within the two source areas are identical. Critical procedures and other detailed information pertaining to the injection equipment and processes are presented in Appendix D. The ZVI powder would be mixed with water (as specified by the ZVI supplier), and extremely low concentrations fracture fluid chemicals (see Appendix D), to form a slurry and then injected into the subsurface at specified injection intervals. Down-hole injection tooling is a proprietary, ported, fixed-tip injection tool which isolates a 3 to 5-inch portion of the borehole during the injections. Fluids are pumped through the drill-rods to the injection tool. A disposal-tip injection tool would be used if there are problems with the fixed-tip tool plugging. Injection pressures at each injection interval are expected to momentarily (less than one second) be as high as 650 pounds per square inch (psi) and then drop to the range of 50 to 200 psi. Damage to existing utilities would be prevented by maintaining a minimum horizontal offset from utilities of 3 feet, and increasing the offset to a minimum of 6 feet when injecting in locations adjacent to sensitive utilities such as fiber optic lines. If surfacing of the injection fluid occurs, pumping would immediately be stopped, and additional boreholes would be advanced to complete the injection dosage at the specified injection interval. While there is no cost-effective or practical means of verifying the radius of distribution (ROD) of the injection fluids in the field, the assumed RODs are conservative and should be more than adequate to achieve the specified remedial objectives.

4.1 Source Area ISCR - Injection of ZVI (Saturated Zone)

Two source areas have been identified which Wasatch believes are the primary source of dissolved phase groundwater contamination: the north source area, a smaller source area associated with the former Stoddard solvent tank area; and the south source area, a larger source area associated with a drum storage area and dry cleaning equipment located in the central production area. The north source area measures approximately 35 feet by 15 feet, and the south source area measures approximately 40 feet square (see Figures 4, 5, and 6).

Wasatch proposes ISCR of the contaminants located in the two source areas, and occurring within the saturated zone, by injection of a ZVI slurry into the saturated zone in each of the two source areas. Injections to treat the saturated zone in the two source areas would be performed at depths of 9 to 29 feet bgs in the north source area, and 9 to 59 feet bgs (final depths vary by boring location as shown on Figures 6, 7, and 8) in the south source area. Injections would be performed at two-foot depth intervals. All borings would be grouted upon the completion of injections. The spacing of borehole locations is based on an expected ROD of 6 to 7.5 feet (calculated by Frac Rite based on assumed fracture thickness and the volume of ZVI slurry injected) based on an injection volume of approximately 53 gallons of ZVI slurry per injection interval. CERES based the ZVI dosing on the contaminant concentrations present and a target *in situ* soil mass dose of 1% ZVI. According to CERES, the 1% *in situ* soil mass dose is an aggressive dosing suitable for sites where DNAPL may be present.

In the north source area, ZVI will be emplaced in three borings to treat the saturated zone (see Figure 6). ZVI slurry would be injected at two-foot intervals from depths of 9 feet to 29 feet bgs in each boring. Approximately 53 gallons of ZVI slurry would be injected at each injection interval each gallon of ZVI slurry would contain approximately 3.3 pounds of ZVI, resulting in a total of approximately 13,063 pounds of ZVI being injected into the saturated zone in the north source area.

In the south source area, ZVI will be emplaced in 20 borings to treat the saturated zone (see Figure 6). ZVI slurry would generally be injected at two-foot intervals varying from 9 feet to 15 feet bgs (along the east side of the south source area) to 9 feet to 59 feet bgs (along the west side of the south source area) in each boring (as shown on Figures 6, 7, and 8). Approximately 53 gallons of ZVI slurry would be injected at each injection interval each gallon of ZVI slurry would contain approximately 3.3 pounds of ZVI, resulting in a total of approximately 56,000 pounds of ZVI being injected into the saturated zone in the south source area.

Actual boring locations would be determined in the field based on the location of utilities and structures.

Information about the ZVI product is presented in Appendix A. Areas where ZVI injections would be performed are shown on Figures 4, 5, and 6.

4.2 Source Area ISCR – *In Situ* Mixing of ZVI (Vadose Zone)

After injections into the saturated zone have been completed (as described in Section 4.1 above), *in situ* soil mixing of ZVI would be performed in each of the two source areas to treat the vadose zone soils (depths of 0 to 7 feet bgs). Soil mixing would be performed by DPS with oversight by a geologist from Wasatch. Areas of Contamination (AOCs) would be established around each of the source areas (the north AOC around the north source area, and the south AOC around the south source area (as shown on Figure 6). The AOCs would each extend outward approximately 15 feet from their respective excavation boundary but would not extend beyond the property boundary or overlap each other. The ZVI and soil mixing would be performed within the footprint of the excavation within each of the AOCs. Soil would not be removed from the AOCs, nor would soil be moved between the AOCs. Soil would not be removed from the AOCs until such time as the soil has been sampled to verify that it meets the cleanup standard and a not-contained-in determination for the soil has been issued by the Utah DWMRC.

The concrete floor slabs would be saw-cut and removed from each of the two source areas where the concrete floor slabs overly the footprint of the source areas (not from the full footprint of the AOCs). Soil mixing would be performed using a long-reach excavator. The soil mixing would be performed working in sections in each of the two source areas. The north source area would likely be worked in two sections (an east section and a west section), and the south source area would likely be worked in four sections (quadrants). A total of approximately 4,339 pounds of ZVI would be added to the soil in the north source area, and a total of approximately 13,404 pounds of ZVI would be added to the soil in the south source area. CERES based the ZVI dosing on the contaminant concentrations present and a target *in situ* soil mass dose of 1% ZVI, an aggressive dosing suitable for sites where DNAPL may be present. When working each section, the soil would be mixed to a depth of 7 feet while gradually adding the prescribed mass of ZVI and gradually bringing the moisture content up to 30 to 40%. The soil mixing contractor would monitor soil moisture using a moisture probe. As the soil in each section is mixed, and after the specified mass of ZVI has been added and moisture content is in the specified range, the soil mixing would continue until, based on visual observations by the Wasatch geologist, the soil and ZVI mixture has been sufficiently homogenized. Soil mixing would then commence on the next section. This process would be repeated in each section until the vadose zone soils in both source areas have been completely treated with the ZVI. Wasatch anticipates that the soil mixing process should require approximately 6 to 10 days to complete.

After the soil mixing has been completed, the soil would be left in place to react with the ZVI and for the moisture content to stabilize for a period of three weeks. After three weeks, the soil would be sampled (as described in Section 7.2) to verify that the soil meets the cleanup standard for the Facility. Once the soil meets the cleanup standard for the Facility, Wasatch would request a not-contained-in determination for the soil from the Utah DWMRC. Upon issuance of the not-contained-in determination, the soil would be removed from each of the excavations and temporarily placed on the concrete floor slabs and/or asphalt pavement. If the moisture content is still too high to achieve compaction, the soil may be left on the concrete and/or asphalt for a period of one to two weeks to dry out. Straw swaddles would be placed around the stockpiles of soil to prevent runoff if the moisture content of the soil is high enough that the soil is free draining. The owner's geotechnical contractor will then be permitted to collect soil samples for Proctor tests to determine the optimum moisture content and maximum dry density of the soil. The data resulting from the Proctor tests will serve as a basis of comparison for the compaction testing. Once the moisture content of the stockpiled soil is in the correct range to achieve compaction, the soil will be placed back in excavations lifts, compacted, and tested for adequate compaction (according to specifications from the geotechnical engineering consultant retained by the owner).

Because the concrete floor slabs and asphalt pavement would be left in place surrounding the excavations where the soil mixing is performed, the excavator would be tracking over paved surfaces, and only the excavator arm and bucket should require decontamination. The soil mixing contractor would be permitted to decontaminate the excavator arm and bucket over the source area excavations using a

pressure washer, potable water, and scrub brushes. Decontamination of the excavator arm and bucket would be required when moving the excavator between AOCs and following the completion of the soil mixing.

4.3 PRBs – Injection of ZVI

PRBs would be installed along the north, west, and a portion of the south side of the Facility (as shown on Figure 6). The PRBs would involve injection of ZVI to reduce the dissolved phase contaminant mass migrating off-site. The ZVI product would be emplaced using specialized hydraulic fracturing and injection tooling by Frac Rite, using direct-push drilling equipment operated by DPS, and with oversight by Wasatch. The ZVI product proposed for this project is Micro Blend (see Appendix A for additional information). The ZVI powder would be mixed with water as specified by the manufacturer to form a slurry and then injected into the subsurface. ZVI slurry would be injected from depths of 9 to 29 feet bgs at two-foot injection intervals (11 injection intervals per boring). The spacing of borehole locations is based on a ZVI slurry load of 53 gallons per injection interval which is expected to result in a ROD of 6 to 7.5 feet (calculated by Frac Rite based on assumed fracture thickness and the volume of ZVI slurry injected). According to CERES, the PRBs would have an expected lifespan of 5 to 10 years.

The north PRB, which would be approximately 165 feet in length, would involve approximately 13 borings spaced approximately 11.5 feet apart. The injections for the north PRB would be completed using 4.95 pounds of ZVI per gallon of water ZVI slurry loading. A total of 583 gallons of ZVI slurry would be emplaced in each PRB injection boring, totaling 7,579 gallons of ZVI slurry and 37,503 pounds of ZVI.

The west PRB, which would be approximately 250 feet in length, would involve approximately 21 borings spaced approximately 11.5 feet apart. The injections for the west PRB would be completed using 5.07 pounds of ZVI per gallon of water ZVI slurry loading. A total of 583 gallons of ZVI slurry would be emplaced in each PRB injection boring, totaling 12,243 gallons of ZVI slurry and 62,047 pounds of ZVI.

The south PRB, which would be approximately 70 feet in length, would involve approximately 6 borings spaced approximately 11.5 feet apart. The injections for the south PRB would be completed using 4.95 pounds of ZVI per gallon of water ZVI slurry loading. A total of 583 gallons of ZVI slurry would be emplaced in each PRB injection boring, totaling 3,498 gallons of ZVI slurry and 17,309 pounds of ZVI.

Actual boring locations would be determined in the field based on the location of utilities and structures.

4.4 Installation of Passive VMS

If warranted, based on data collected following active remediation, Wasatch proposes the installation of a passive VMS, in conjunction with a vapor barrier (as discussed below), to mitigate the accumulation of chlorinated solvent vapors beneath the floor slab of the new on-site structure. The passive VMS would be constructed so as to be easily converted to an active VMS should the need arise. The VMS would consist of one vent stack per approximately 2,500 square feet of ground-level floor space intended for human occupancy. As the preliminary building design consists of approximately 5,170 square feet of ground-level floor space intended for human occupancy, Wasatch is recommending that a minimum of two vent stacks be installed at the Facility. The approximate locations of the VMS vent stacks (based on the preliminary building design) and the general design of the passive VMS are presented in Appendix B. The final VMS design will be based on the final building design and the placement of the vent stacks will be determined in cooperation with the architectural firm completing the building design. The final VMS design will be submitted to the Utah DWMRC for review and approval prior to construction of the new building.

The VMS system described in this section is specifically intended for the new structure to be constructed on-site; however, a system of similar design could be implemented for a structure(s) constructed on owner-controlled off-site properties and/or non-owner-controlled off-site properties, if necessary, using the same design guidelines. The VMS system(s) could also be constructed as, or converted to, an active VMS system if required as illustrated in Appendix B.

4.5 Installation of Vapor Barrier

Wasatch proposes the installation of a vapor barrier underlying the entire area of the floor slab of the new on-site and owner-controlled off-site structures. Wasatch is specifying Drago® Wrap vapor intrusion barrier, manufactured by Stego Industries, LLC, for this project. Drago® Wrap is a 20-mil thick, multi-layer material engineered for use as a vapor barrier to prevent vapor intrusion into structures located on VOC-contaminated properties. Drago® Wrap has been performance tested against a wide range of VOCs including PCE and TCE. Installation of the vapor barrier would be performed by a qualified contractor and the installation would be inspected by Wasatch. Specifications and installation instructions for the vapor barrier are provided in Appendix C.

The vapor barrier described in this section is specifically intended for new construction for the on-site and owner-controlled off-site structures and is only applicable to new construction. If a vapor barrier is deemed necessary for an existing structure(s) located on non-owner-controlled off-site properties, Wasatch would recommend an epoxy-based vapor barrier that can be applied to the top surface of an existing floor slab (i.e., Retro-Coat™ by Land Science Technologies or Vaportight® Coat by Aquafin).

4.6 General Demolition, Construction, and Decontamination Issues

The following best management practices would be employed during implementation of the remedies specified in this CAP:

- The owner would have a pre-demolition inspection performed, have universal wastes and asbestos-containing building materials removed and properly disposed, and obtain a demolition permit prior to demolition of the existing structure.
- The DWMRC would be notified and provided with an opportunity to be present on-site to observe the removal of the floor slabs and subsurface features such as the OWS and north sump.
- Storm drain openings would be covered and runoff would be controlled during building demolition, drilling, and excavation activities to prevent mud and contaminants from entering the storm sewer system.
- Facility access would be limited by erecting temporary chain-link fencing around the entire Facility prior to commencement of the remediation field work. The fencing would remain in place for the duration of the field work.
- The drilling/soil mixing and injection subcontractors would be required to decontaminate their equipment prior to arrival at the Facility, and prior to demobilization from the Facility.
- Decontamination of the excavator arm and bucket would be performed over the source area excavations using a pressure washer, potable water, and scrub brushes (as described in Section 4.2).
- Decontamination of drill-rods would be performed over a small decontamination pad constructed with an impermeable liner (such as a heavy-duty tarp) draped over sidewalls that would contain the fluids (such as timers or railroad ties) using a pressure washer, potable water, Alconox® (or similar non-phosphate detergent), and scrub brushes. Sediment and fluids generated during decontamination would be collected and drummed for off-site disposal.
- Decontamination of field sampling equipment is described in standard operating procedure (SOP) 22 (Appendix E).
- Decontamination of field personnel boots would be performed in a small plastic kiddie pool using potable water, Alconox® (or similar non-phosphate detergent), and scrub brushes. Sediment and fluids generated during decontamination would be collected and drummed for off-site disposal.

4.7 DWMRC Acknowledgement of Corrective Action Implemented

The owner requests that, upon completion of the corrective action measures described above (excluding the installation of vapor barriers and VMSs in the new structures to be constructed at the Facility and owner-controlled off-site properties), the DWMRC issue a letter acknowledging that the corrective action has been implemented and that redevelopment construction will not interfere with the corrective action measures or monitoring. The DWMRC has indicated a willingness to issue such a letter as an interim

acknowledgement of the corrective action status. The owner understands that data from confirmation sampling, performance monitoring, and potentially long-term monitoring would need to meet acceptable risk-ranges for the designated land use and redevelopment plan; and meet or show a trend toward meeting the established site-specific cleanup levels for groundwater, before regulatory closure can be achieved. The owner further understands that the DWMRC's letter acknowledging that construction can proceed without interfering with corrective action measures or monitoring, will be conditioned upon monitoring and possible further injections of ZVI until regulatory closure is achieved.

5. PERMITTING REQUIREMENTS

5.1 Blue Stakes Utility Clearance Request

A utility clearance request would be submitted to Blue Stakes at least two full business days prior to the commencement of the remediation work. The Blue Stakes utility clearance would be renewed every 12 calendar days for the duration of the project. Wasatch would also have DPS perform a private utility locate prior to the commencement of work.

5.2 Underground Injection Control Permit

Wasatch would submit an application for an Underground Injection Control (UIC) permit to the Utah Division of Water Quality (DWQ) for Class 5B6 beneficial use injection well(s) [subsurface environmental remediation injection well(s)] prior to the commencement of field work. Injections would not be performed until the UIC permit has been approved. Wasatch would notify the Utah DWQ when the work has been completed and the permit can be discontinued.

5.3 Storm Water Pollution Prevention Plan (SWPPP)

As the facility occupies less than 1 acre, a SWPPP is not required for the work described in this CAP. Subcontractors will be required to use best management practices (i.e., cover exposed storm drains and manage runoff, etc.) to prevent adverse impacts to the storm sewer system.

5.4 Utah Division of Air Quality (DAQ) Requirements

Mr. Alan Humphries, Environmental Program Manager over minor source permitting with the Utah Division of Air Quality (DAQ) stated that, because the soil mixing areas total less than ¼-acre in aerial extent, a fugitive dust control plan is not required. Therefore, Wasatch plans to use best management practices typically used for construction site to abate any potential fugitive dust issues.

Because the majority of the work would be performed *in situ*, significant odors from VOCs are not expected. However, Wasatch will be prepared to cover or wet soils, reduce or stop work, or implement other measures approved or requested in consultation with UDEQ if odors become a concern.

The Utah DAQ no longer requires monitoring and reporting of emissions from passive or active VMSs to comply with the requirements of Utah Administrative Code R307-401-15. Emissions monitoring and reporting of emissions from the VMSs will not be performed.

6. NOTIFICATIONS

The following notification requirements will be met:

- The Salt Lake County Health Department will be notified 72 hours prior to commencement of field work related to the corrective action.
- The Utah DWMRC will be notified at least 10 days prior to any field work.
- As a courtesy, businesses and residents located adjacent to the Facility will be notified at least 14 days prior to commencement of the remediation work.

- A 30-day public comment period will be required for the SMP.

7. SAMPLING AND ANALYSIS

Sampling methods and procedures specified in this CAP, and the SOPs presented in Appendix E, are intended to apply to sampling activities specified in this CAP as well as to future work plans which may be submitted to both the owner and the Utah DWMRC project manager for review and approval. Sampling activities will be planned so as to meet the project objectives detailed in Section 1.3 of this CAP. Sampling methods and procedures as addressed in this CAP and future work plans may be conducted in conjunction with:

- Any remaining site characterization issues;
- Evaluation of the potential for vapor intrusion into on-site and off-site structures (non-owner-controlled off-site structures will be screened to residential standards);
- Evaluation of the actual impacts to indoor air for any structures for which a vapor intrusion risk is identified;
- Implementation and evaluation of selected remedies to address on-site source areas and impacts to groundwater both on-site and off-site;
- Implementation and evaluation of appropriate measures to mitigate any vapor intrusion risks, into both on-site and off-site structures, that may be identified;
- Soil confirmation sampling following the removal of any subsurface features (i.e., OWS, north sump, and previously unidentified subsurface features where contamination is identified);
- Waste characterization sampling;
- Soil confirmation sampling following the implementation of the selected remedies;
- Groundwater monitoring following the implementation of the selected remedies; and
- Indoor air monitoring following the implementation of the selected mitigation measures.

Utility clearance will be requested through Blue Stakes of Utah prior to commencement of any sampling activities that will require drilling.

All necessary permits (i.e., right of way encroachment permits, etc.) will be obtained by Wasatch prior to commencement of any sampling activities.

The sampling methods and field procedures Wasatch anticipates utilizing are presented as SOPs contained in Appendix E of this CAP. The specific sampling methods to be utilized for each phase of work will be identified, and the appropriate SOPs have been referenced in this CAP and will be referenced in each work plan that is submitted for review and approval. If sampling methods become beneficial or necessary that are not included in the SOPs, an SOP will be developed for such sampling methods. The new SOPs will be presented in the applicable work plan and amended to the CAP.

The laboratory analytical methods Wasatch anticipates utilizing for most aspects of the project are summarized in Table 1. Additional laboratory analytical methods will be required for waste characterization. Laboratory analytical requirements for waste characterization will be dependent upon the waste media, analytes detected in the environmental samples associated with the waste, requirements stipulated by the receiving facility, and regulatory requirements. The standard laboratory analytical methods Wasatch anticipates utilizing are summarized in Table 2 (subject to modification at the request of the receiving facility).

7.1 Waste Characterization Sampling

Wasatch does not anticipate generating any waste soil or groundwater in conjunction with the injections or soil mixing; however, a small quantity of soil and groundwater waste would be generated during sampling conducted in conjunction with potential additional site characterization activities, soil confirmation sampling, and groundwater monitoring activities. Waste soil may also be generated in conjunction with the removal of subsurface features (i.e., OWS, north sump, or previously unidentified

subsurface features, etc.). If contamination is discovered during the removal of these subsurface features, Wasatch would perform waste characterization sampling in accordance with the CAP and complete the appropriate waste profiles to be approved by the facility receiving the waste based on the waste characterization sampling results. All waste will be properly contained in labeled 55-gallon drums or roll-off containers pending laboratory analysis and proper transport and disposal. Analysis of waste characterization samples would be performed as specified in Table 2, subject to revision to accommodate any additional analyses that may be required by the receiving facility.

Wasatch would arrange for proper transport and disposal of the waste soil and groundwater through Clean Harbors or other appropriate transport, storage, and disposal facilities.

7.2 Soil Confirmation Sampling

Soil confirmation sampling will be performed in the north source area, south source area, OWS excavation, and north sump excavation following corrective action (as well as in any unknown features and locations that may be discovered when the floor slabs of the building are removed, as discussed in Section 8 of this CAP). Soil confirmation samples will be collected to verify that contaminant mass reductions in soil are occurring, and that the cleanup levels have been, or will be, met.

Soil samples would be collected from the north and south source areas no sooner than 30 days following the completion of the ISCR injections and soil mixing.

Wasatch proposes advancing two soil borings using direct-push drilling methods in the north source area for the purposes of soil confirmation sampling. The boring locations would be evenly distributed throughout the source area approximately as shown on Figure 9. Borings would be advanced to a depth of 10 feet bgs. To be representative of the full depth of the construction worker zone, sample aliquots from each boring would be collected at 2-foot depth intervals from the ground surface to a depth of 10 feet. The sample aliquots from each boring would then be composited together to form one composite soil sample representative of that boring (each boring would be represented by one composite soil sample). Samples from the north source area would be analyzed for full list VOCs and PAHs as specified in Table 1.

Wasatch proposes advancing six soil borings using direct-push drilling methods in the south source area for the purposes of soil confirmation sampling. The boring locations would be evenly distributed throughout the source area approximately as shown on Figure 9. Borings would be advanced to a depth of 10 feet bgs. To be representative of the full depth of the construction worker zone, sample aliquots from each boring would be collected at 2-foot depth intervals from the ground surface to a depth of 10 feet. The sample aliquots from each boring would then be composited together to form one composite soil sample representative of that boring (each boring would be represented by one composite soil sample). Samples from the south source area would be analyzed for full list VOCs as specified in Table 1.

The soil borings would be advanced in 5-foot increments using a direct-push drill rig (in accordance with SOP 4). Soil cores would be collected from 5-foot long by 1.5-inch diameter discrete interval push samplers equipped with disposable polybutyrate liners. Soil cores would be field screened with a MiniRae 3000 photoionization detector (PID) equipped with an 11.7 electronvolt lamp. The soil cores would be field logged by an experienced geologist (in accordance with SOP 10). The field logging would include a description of color, moisture content, consistency, odor, staining, and soil type based on the Unified Soil Classification System. Soil samples would be collected from the locations and depth intervals specified above and submitted for laboratory analysis. Composite soil samples for VOC analysis would be collected using a laboratory-supplied sampling device, sample preservation methods, and sample containers consistent with U.S. EPA method 5035A. Composite soil samples would be collected from each boring for both low-range (0.5 to 250 µg/kg) and high-range (>250 µg/kg) laboratory analysis for VOCs. Low-range soil samples would be collected as 5-gram (g) aliquots and placed in laboratory-supplied, unpreserved volatile organic analysis (VOA) bottles, and immediately placed in a cooler with dry ice. High-range samples would be collected as 10-g aliquots and placed in laboratory-supplied VOA bottles preserved with methanol and immediately placed in a cooler with ice. Composite soil samples for

SVOC and PAH analysis would be collected with gloved hands and dispensed into 4-ounce glass jars. Soil samples would be analyzed for VOCs using U.S. EPA Method 8260D and SVOCs and PAHs would be analyzed using U.S. EPA Method 8270E. All soil samples would be placed in an iced cooler and delivered under chain-of-custody protocol to American West Analytical Laboratories (AWAL), a Utah-Certified analytical laboratory, for analysis. Soil samples would be analyzed on standard laboratory turnaround time unless Wasatch is directed by the owner to expedite the analyses.

At least one confirmation soil sample will be collected from beneath the OWS after it has been removed from the ground. If there are field indications of a release from the OWS and excavation of impacted soil is required, one soil sample would be collected from the floor of the excavation and one soil sample would be collected from each sidewall of the excavation. Soil samples from the OWS would be submitted for analysis of VOCs and SVOCs as specified in Table 1.

At least one confirmation soil sample will be collected from beneath the north sump after it has been removed from the ground. If there are field indications of a release from the north sump and excavation of impacted soil is required, one sample would be collected from the floor of the excavation and one soil sample would be collected from each sidewall of the excavation. Soil samples from the north sump would be submitted for analysis of VOCs and SVOCs as specified in Table 1.

Soil confirmation samples would also be collected from the floor and sidewalls of any excavations conducted at the Facility where contamination has been identified in association with any previously unidentified subsurface features discovered when the floor slabs are removed.

7.3 Groundwater Confirmation Sampling

Wasatch anticipates that many of the existing monitoring wells located both on and off-site will be abandoned during remediation and redevelopment of the Facility, and that new monitoring wells will be installed to complete the groundwater monitoring network. Wasatch further anticipates that at least some of the new monitoring wells will be clustered monitoring well sets installed with screened intervals targeted to monitor different depths within the aquifer. The nested monitoring wells would also be used to evaluate the vertical hydraulic gradient and to evaluate variations in the direction and magnitude of the horizontal hydraulic gradient. The monitoring well network will likely evolve over time. Changes to the monitoring well network, including the location and screened intervals for new monitoring wells, will be subject to DWMRC review and approval.

Wasatch proposes sampling the shallow, intermediate, and deep performance monitoring wells monthly for the first quarter following corrective action. See Table 5 for a list of specific performance monitoring wells. Given that the proposed construction activities at the Facility will destroy the proposed performance monitoring wells in the north and south source areas, only the shallow performance monitoring well for the north source area (MW-110) and south source area (MW-111) will be installed and sampled to evaluate risk in these areas, as performance monitoring wells MW-110M, MW-110D, MW-111M, MW-111D will not be constructed until after the proposed structure in this area has been constructed. Wasatch proposes that all wells listed as routine long-term monitoring wells (which includes the performance monitoring wells) be sampled quarterly for the remainder of the first year, using low flow sampling techniques (in accordance with SOP 14). The exception to this is monitoring wells MW-110M, MW-110D, MW-111M, MW-111D, MW-112, MW-112M, and MW-112D, as these wells cannot be installed until after construction of the proposed structures. Once these wells are installed, they will be sampled as part of the long-term monitoring and performance network as defined in Table 5. After the first year of groundwater monitoring, the monitoring well network, frequency of monitoring, and field methods for monitoring would be reevaluated in consultation with the DWMRC.

Groundwater samples would be analyzed on standard laboratory turnaround time unless Wasatch is directed by the owner to expedite the analyses. Purge water would be contained in a properly labeled 55-gallon drum for proper disposal.

Groundwater monitoring reports would be submitted to the owner and the Utah DWMRC on a quarterly basis within 60 days of the completion of the first three rounds of monthly groundwater monitoring, and after each quarterly groundwater monitoring event. Groundwater monitoring reports would include:

- narrative text explaining objectives, methods, results, and presenting conclusions and recommendations;
- comprehensive groundwater data tables;
- a map depicting the sample locations;
- maps depicting analyte concentrations;
- a map depicting the groundwater elevations and hydraulic gradient;
- laboratory analytical reports; and
- data validation reports.

7.4 Indoor Air Sampling

Wasatch proposes collecting one round of indoor air samples prior to occupancy of the new structures constructed on-site and on the owner-controlled off-site properties. Wasatch further proposes collecting a minimum of one round of indoor air samples from any non-owner-controlled off-site structures where a vapor intrusion risk has been confirmed through soil gas sampling or where vapor intrusion mitigation measures have been implemented. Indoor air sampling would be conducted in accordance with SOP 19. In conjunction with any indoor air samples collected, an outdoor air sample will be collected to establish ambient background concentrations. Prior to collecting indoor air samples, the occupants (if any) would be interviewed to ascertain whether or not dry cleaned clothing has been brought into the structure, or carpets have been professionally cleaned, within the preceding two weeks. Additionally, the occupants would be interviewed to ascertain what recent activities have been conducted within the structure, and if any products known to contain chlorinated solvents are present. Next a chemical inventory would be performed to identify and remove any products containing chemicals of concern (any chlorinated solvents). This procedure would be followed to reduce the potential for false positive results in the indoor air samples (i.e., the detection of chlorinated solvents in the indoor air samples resulting from sources inside the structure rather than from beneath the floor slabs). Products discovered during the chemical inventory that contain chlorinated solvents would be removed from the structure for a minimum of two week prior to sampling activities. All products would be documented in a field notebook.

Chain-of-custody documentation would be completed, and the samples would be delivered to ALS Environmental for the analysis of VOCs. All samples would be analyzed on a standard laboratory turn-around time unless expedited analysis is requested by the owner.

8. Contingency Planning

Samples would be collected from beneath the OWS, north sump, and any other previously unidentified subsurface features where there may be indications of a release. If contamination above residential screening levels is confirmed through this sampling; the soil would be excavated, Wasatch would perform waste characterization sampling, and Wasatch would complete the appropriate waste profiles to be approved by the facility receiving the waste. All waste would be properly contained in labeled 55-gallon drums or roll-off containers pending laboratory analysis and proper transport and disposal.

If contamination is discovered in unexpected locations, at unexpected concentrations, or if new contaminants discovered that were not expected based on Facility history and previous data; Wasatch would immediately communicate relevant findings to the owner and the Utah DWMRC and work to develop an appropriate remedial alternative.

If the data resulting from confirmation sampling, groundwater monitoring, or indoor air sampling indicate that the remedial strategy, after implementation, has not been effective at remediating the contamination (either in localized areas or throughout the areas impacted by releases from the Facility) Wasatch would

immediately communicate relevant findings to the owner and the Utah DWMRC and work to develop an appropriate remedial alternative.

It is impossible for Wasatch to develop specific contingencies and speculate as to what specific responses would be appropriate, without knowing the specific conditions and circumstances to which the contingencies are responding. Contingency responses would always be developed in a manner consistent with the intended land use, applicable laws and regulations, and with the objectives expressed by the owner.

9. QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

All laboratory data generated as an aspect of this corrective action will be subject to third-party data validation and appropriate QA/QC samples will be collected to support data validation.

9.1 DATA QUALITY PARAMETERS AND OBJECTIVES

The overall QA/QC objective for this project is to develop and implement procedures for field sampling, chain-of-custody, laboratory analyses, and reporting that will provide results, which are valid and legally defensible in a court of law. The purpose of implementing these procedures is to assess the data obtained with respect to the data quality parameters of precision, representativeness, accuracy, completeness, and comparability for both the laboratory analytical program and field sample collection activities. The primary goal of the program is to ensure that the data generated are representative of environmental conditions at the Facility. To achieve this goal, a combination of quantitative procedures and qualitative evaluations will be used to assess the data quality. Precision, accuracy, representativeness, completeness, and comparability (PARCC) will be computed in the manner described in the following paragraphs. A qualitative assessment of PARCC factors will be made and will be documented. Data quality objectives (DQOs) are qualitative and quantitative statements that specify the quality of the data required to support decisions made during project activities and are based on the end uses of the data to be collected. The DQOs for the former Henries Dry Cleaner project are summarized in Table 3.

Field QC sample types and quantities by matrix are summarized in Table 4.

9.2 Precision

Precision is a measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions, and typically expressed in terms of the standard deviation or relative percent difference (RPD).

9.2.1 Field Data Precision

Field precision will be assessed through the collection and analysis of field duplicates and comparing the analytical results of the field duplicates to the analytical results of the environmental samples.

9.2.2 Laboratory Data Precision

Laboratory precision will be assessed through the calculation of RPD and/or relative standard deviations (RSD) for duplicate samples. Analytical precision will be measured by comparing analytical results for matrix spike (MS) and matrix spike duplicate (MSD) samples and internal laboratory samples that may be analyzed according to analytical method or laboratory standard operating procedure requirements. Acceptance criteria for analytical precision will be based on established laboratory quality control limits for individual analytes. Applicable control limits are based on statistically valid historical data compiled by the laboratory, which meet or exceed

precision requirements specified by the analytical method. SOPs are on file with the selected project laboratory.

9.3 Accuracy

Accuracy is the degree of agreement of a measurement with an accepted reference or true value. The accuracy of the analytical data will be assessed by examining possible sources of error that may bias the analytical results.

9.3.1 Field Data Accuracy

Sources of the errors in the field can occur during sampling (i.e., cross contamination from sampling equipment, etc.), field handling, and transportation. Accuracy in the field will be assessed by documenting adherence to SOPs for sample collection, preservation, and handling; and through preparation and analysis of trip blanks and equipment blanks.

9.3.2 Laboratory Data Accuracy

Sources of errors in the laboratory can occur during sample preparation and analysis, duplicate and control sample preparation, and instrument and quantification errors. Laboratory accuracy is assessed through the analysis of standard reference materials (SRMs) in laboratory control samples, MSs, MSDs, and surrogate compounds and the determination of their recoveries in terms of percentage. Control limits are established by the laboratory for each analyte based on statistically valid historical recovery results, which meet or exceed the requirements specified by the analytical method. In addition, the project laboratory will analyze method blanks to determine the potential for contamination introduced at any stage of sample preparation or analysis. Laboratory control limits and frequency for spike recovery and method blank analysis are specified in SOPs for each analytical method, which are on file with the selected project laboratory.

9.4 Representativeness

Representativeness is a qualitative parameter that expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. As such, representativeness requires the selection of appropriate analytical methods, sampling protocols, and sampling locations such that results are representative of the media being sampled and conditions being measured.

9.4.1 Field Data Representativeness

Representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the CAP, and the specific procedures contained therein, is followed. If a network of groundwater monitoring wells is installed, the groundwater monitoring well network will be designed to provide data that are representative of site conditions.

9.4.2 Laboratory Data Representativeness

Representativeness in the laboratory is ensured by carefully following standard laboratory analytical methods and procedures, meeting sample holding times, specifying detection limits that are at or below regulatory standards, and analyzing method blanks to check for laboratory contamination. Sample results will not be considered representative if contaminants are detected in the method blanks, or if the reporting limits are above the specified screening levels.

9.5 Completeness

Completeness is an assessment of the number of valid measurements obtained in relation to the total number of measurements planned for the successful achievement of the investigative objectives. Completeness will be expressed as the percentage of valid measurements to the total number of measurements. The closer the numbers, the more complete the measurement process.

9.5.1 Field Data Completeness

Field completeness evaluates the number of valid measurements obtained from all measurements taken in the project. The intent of this program is to attempt to achieve a goal of 100 percent completeness. Realizing that under normal conditions this goal may not be achievable, the completeness goal for this program is 85 percent. This completeness goal is considered adequate to meet the DQOs for this Facility based on prior consideration of PARCC parameters, the sampling plan designs, and data collection activities proposed for each medium.

9.5.2 Laboratory Data Completeness

Laboratory completeness evaluates the number of valid measurements obtained from all the measurements taken in the project. The intent of this program is to attempt to achieve a goal of 100 percent laboratory completeness. Realizing that under normal conditions this goal may not be achievable, the laboratory completeness goal for this program is 85 percent.

9.6 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set may be compared to another. Data sets will be compared only when precision and accuracy meet the specified acceptance criteria established in this section. Samples will be collected, and analytical results will be reported according to standard procedures and methods to ensure comparability with other similar data and results. The comparability goal will be achieved by following the CAP, and the specific procedures contained therein, and by collecting and analyzing representative samples, specifying analysis by similar analytical procedures with comparable reporting limits and by reporting analytical results in appropriate and consistent units.

9.6.1 Field Data Comparability

Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the CAP is followed and that proper sampling procedures are used.

9.6.2 Laboratory Data Comparability

Analytical data will be considered comparable when similar sampling and analytical methods are used and documented. Similar QA objectives will be used throughout the project to ensure comparability. At the discretion of the Utah DWMRC, split samples may be collected for submittal to a third-party laboratory to assist in evaluation of comparability. The frequency at which split samples are collected and analyzed will be specified by the Utah DWMRC following the receipt and approval of individual work plans for the project.

9.7 Field QA/QC

A variety of QC samples will be collected to facilitate the evaluation of the data quality parameters. An explanation of each type of field QC sample is provided below. A summary of the quantity of each QC sample type to be collected for each environmental medium (matrix type) is presented as Table 4.

9.7.1 Matrix Spike (MS)/Matrix Spike Duplicate (MSD)

MS/MSDs are QC samples collected in the field for use by the analytical laboratory. The MS/MSDs are selected to be representative of the environmental matrix at the Facility. The laboratory spikes the MS/MSDs with a known quantity of the analyte of interest. The MS and MSD are then analyzed by the laboratory along with an un-spiked sample and the environmental samples from the Facility to evaluate the accuracy and precision of the analytical method for that specific sample. A minimum of one MS/MSD will be collected for each matrix (soil and groundwater samples only) for each sample delivery group, or one MS/MSD for each matrix (soil and groundwater only) for every 20 environmental samples, whichever is greater.

9.7.2 Field Duplicate

A field duplicate is a QC sample collected from the same location as an environmental sample, and collected simultaneously, or immediately following, the collection of the environmental sample. Field duplicates are collected, handled, and analyzed in an identical manner to the environmental samples. The sample labeling and chain of custody documentation will not indicate that a sample is a field duplicate (they are blind duplicates) so the analytical laboratory is not aware that the field duplicate is a QC sample. Field duplicates are analyzed by the laboratory along with the environmental samples. The analytical results for the field duplicate are then compared to the analytical results for the environmental sample as an indicator of the overall sampling and analytical precision. One field duplicate will be collected for each matrix (soil, groundwater, and indoor air samples only) for every 10 environmental samples for each matrix. A minimum of one field duplicate per matrix will be collected for each sampling event.

9.7.3 Equipment Blank

An equipment blank (also referred to as an equipment rinsate blank) is a QC sample collected by pouring deionized water over sampling equipment after the sampling equipment has been completely decontaminated. Equipment blanks will only be collected when non-dedicated and non-disposable sampling equipment are used. Equipment blanks will be analyzed for the same analytes as the environmental samples. The analytical results for the equipment blanks are used to evaluate the adequacy of the decontamination procedures used to prevent cross-contamination between sampling locations. One equipment blank will be collected for each matrix (soil and groundwater only) for every 20 environmental samples for each matrix.

9.7.4 Trip Blank

A trip blank is a QC sample prepared by the laboratory consisting of a set of sample vials filled with deionized water. Trip blanks are transported and stored with environmental samples (soil and groundwater samples only) that are to be analyzed for VOCs. Trip blanks are analyzed for VOCs only. Trip blanks are collected and analyzed to evaluate for cross-contamination of VOC samples due to diffusion that may occur during transport and storage of environmental samples. One trip blank will be included in each cooler used to transport VOC samples.

9.7.5 Split Samples

A split sample is a QC sample collected from the same location as an environmental sample, and collected simultaneously, or immediately following, the collection of the environmental sample. Split samples are transported and analyzed separately (and by a different analytical laboratory) than the environmental samples. The analytical results for the split sample are then compared to the analytical results for the environmental sample as an indicator of the overall analytical accuracy and precision. The Utah DWMRC may collect splits of soil, groundwater, and indoor air samples at their discretion.

10. CORRECTIVE ACTION IMPLEMENTATION REPORT

Following completion of the corrective action, Wasatch would produce a corrective action implementation report documenting the results of the corrective action. The report would include:

- narrative text explaining objectives, methods, results, and presenting conclusions and recommendations, and documenting any deviations from the approved CAP;
- data tables;
- figure(s) depicting the location of injections, source areas, confirmation samples, and monitoring wells, and other relevant features;
- photographs;
- laboratory analytical reports;
- data validation reports; and
- copies of permits and approvals.

11. HEALTH AND SAFETY

All corrective action activities at the Facility would be performed by Wasatch and our subcontractors in accordance with Wasatch's general health and safety policy. A site-specific health and safety plan would also be prepared to address specific health and safety concerns and establish protocols for conducting work related activities in a safe manner.

12. PROJECT SCHEDULE

The timing of the corrective action work described in this CAP will be largely dependent on the timing of the building permit approvals. Demolition of the on-site building and site remediation would likely commence shortly thereafter. Wasatch anticipates completing the remediation work during the spring or summer of 2021. Wasatch would communicate scheduling details with the Utah DWMRC as the schedule develops.

13. REFERENCES

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Tables

Table 1
Summary of Laboratory Analytical Methods

Target Analytes	Environmental Media	Laboratory Analytical Methods
VOCs, full list (including chlorinated solvents and chlorinated solvent breakdown products)	Soil	SW-846 5035A/8260D
	Groundwater	SW-846 8260D
	Soil Gas	U.S. EPA TO-15
	Indoor Air	U.S. EPA TO-15
SVOCs, full list ¹	Soil	SW-846 8270E
	Groundwater	SW-846 8270E
	Soil Gas	Not applicable
	Indoor Air	Not applicable
Polycyclic Aromatic Hydrocarbons (PAHs), full scan and single selected ion mode (SIM) ²	Soil	SW-846 8270E
	Groundwater	SW-846 8270E
	Soil Gas	Not applicable
	Indoor Air	Not applicable

Notes:

¹ – SVOCs will be sampled only for the OWS and north sump (where TPH-GRO and TPH-DRO were previously detected), unless a technical justification arises that indicates a potential for SVOC contamination elsewhere.

² – PAHs will be sampled only for the north source area, unless a technical justification arises that indicates a potential for PAH contamination elsewhere.

Table 2
Summary of Standard Laboratory Analytical Methods for Waste Characterization

Waste Media	Target Analytes	Laboratory Analytical Methods
Soil	pH	U.S. EPA 9045D
	Ignitability	U.S. EPA 1010A
	Reactivity	Sec. 7.3.3, 7.3.4, and 8.3 (Delisted, no longer part of SW-846)
	RCRA F and D-List TCLP and Total VOCs	U.S. EPA 8260D
	RCRA F and D-List TCLP and Total SVOCs	U.S. EPA 8270E
	RCRA F and D-List TCLP and Total Metals	U.S. EPA 6020B and 7470A/7471B
Groundwater	pH	U.S. EPA 9045D
	Ignitability	U.S. EPA 1010A
	Reactivity	Sec. 7.3.3, 7.3.4, and 8.3 (Delisted, no longer part of SW-846)
	RCRA F and D-List VOCs	U.S. EPA 8260D
	RCRA F and D-List SVOCs	U.S. EPA 8270E
	RCRA F and D-List Total Metals	U.S. EPA 6020B and 7470A/7471B

Notes:

RCRA – Resource Conservation and Recovery Act

TCLP – Toxicity Characteristic Leaching Procedure (preparation method 1311 or 1312)

Table 3
Summary of DQOs

QC Parameter	DQO
Precision	Relative percent difference (RPD) of field and laboratory duplicate (MS/MSD) samples. For laboratory duplicates, the RPDs within established laboratory control limits for each analyte are acceptable. For soil and indoor air field duplicates, a calculated RPD of 50% will be deemed acceptable. For groundwater field duplicates, a calculated RPD of 20% will be deemed acceptable.
Accuracy	Spike recoveries from laboratory control samples (LCSs), MS/MSDs, and surrogates within established laboratory control limits for each analyte are acceptable.
Representativeness	Environmental samples will be collected from locations either reasonably believed to be, or established to be, representative to identify source areas, evaluate the nature of the release(s), and delineate the extent of contamination. Standard field operating procedures will be used, method blanks are to be free of target analytes, sample holding times are not to be exceeded, all samples are to be properly preserved, receiving temperatures are not to be exceeded, 90% of all field duplicates meet laboratory precision criteria, and laboratory method detection limits must be below the applicable screening levels.*
Completeness	An acceptable level of completeness will be defined as 85% of collected samples being deemed valid based on precision, accuracy, representativeness, and comparability acceptance criteria.
Comparability	Where feasible (where previous data exist as with monitoring wells), analytical results for environmental samples will be compared to previous analyses for the respective location. Measures of comparability will include the use of standard analytical methods with standard units of measure and consistent reporting limits, and collection of field QC samples.

* The representativeness has been established requiring that 90% of all field duplicates meet the established precision criteria and detection limits will be below applicable screening levels; however, if sample dilution occurs because of elevated analyte concentrations, the results will not be rejected.

Table 4
Summary of Field QC Sample Types and Quantities by Matrix

Environmental Media (Matrix)	MS/MSD	Field Duplicate	Equipment Blank	Trip Blank	Split Samples
Soil	A minimum of 1 per sample delivery group, all analytes, or 1 per 20 environmental samples, whichever is greater	1 per 10 environmental samples, all analytes, minimum of 1 per sampling event	1 per 20 environmental samples, all analytes, only if non-dedicated sampling equipment is used	1 in each cooler containing VOC samples	At discretion of DWMRC
Groundwater	A minimum of 1 per sample delivery group, all analytes, or 1 per 20 environmental samples, whichever is greater	1 per 10 environmental samples, all analytes, minimum of 1 per sampling event	1 per 20 environmental samples, all analytes, only if non-dedicated sampling equipment is used	1 in each cooler containing VOC samples	At discretion of DWMRC
Soil Gas	None	None	None	None	None
Indoor Air	None	1 per 10 environmental samples, VOCs only, minimum of 1 per sampling event	None	None	At discretion of DWMRC

Table 5
Monitoring Plan Summary

Groundwater Monitoring Depth Zone	Well I.D.	Total Well Depth (feet)	Screen Interval (feet)	Groundwater Elevation Data	Performance Monitoring	Routine Long-Term Monitoring	Existing?	Abandon?	Install or Replace?	Notes
Shallow	MW-100	15	5 - 15	X		X	No	No	Yes	Well was abandoned (damaged sewer line) and needs to be replaced
	MW-101	15	5 - 15	X		X	Yes	No	No	Downgradient well
	MW-102	15	5 - 15	X		X	Yes	No	No	Downgradient well
	MW-103	15	5 - 15				Yes	Yes	No	Cross-gradient well
	MW-104	15	5 - 15	X		X	Yes	No	No	Down/Cross-gradient well
	MW-105	15	5 - 15	X	X	X	Yes	No	No	Performance monitoring of south source area
	MW-106	15	5 - 15				Yes	Yes	No	Upgradient well
	MW-107	15	5 - 15	X	X	X	Yes	No	No	Performance monitoring of north source area
	MW-108	15	5 - 15	X		X	Yes	No	No	Cross-gradient sentinel well
	MW-110	15	5 - 15	X	X	X	No	No	Yes	North source area well
	MW-111	15	5 - 15	X	X	X	No	No	Yes	South source area well
	MW-112	15	5 - 15	X		X	No	No	Yes	Upgradient well
	HD-MW-01	15	5 - 15				Yes	Yes	No	Building interior well near south source area
	HD-MW-02	15	5 - 15				Yes	Yes	No	Building interior well near south source area
	HD-MW-03	15	5 - 15				Yes	Yes	No	Building interior well near south source area
	HD-MW-04	15	5 - 15				Yes	Yes	No	Building interior well near south source area
	HD-MW-05	15	5 - 15				Yes	Yes	No	Building interior well near south source area
	HD-MW-06	15	5 - 15				Yes	Yes	No	Building interior well near south source area
	HD-MW-07	15	5 - 15	X	X	X	Yes	No	No	Performance monitoring of south source area
Intermediate	MW-100M	30	20 - 30	X		X	Yes	No	No	Downgradient sentinel well
	MW-102M	30	20 - 30	X		X	Yes	No	No	Downgradient well
	MW-104M	30	20 - 30	X		X	Yes	No	No	Downgradient well
	MW-105M	30	20 - 30	X	X	X	No	No	Yes	Performance monitoring south source area
	MW-107M	30	20 - 30	X	X	X	Yes	No	No	Performance monitoring north source area
	MW-108M	30	20 - 30	X		X	Yes	No	No	Cross-gradient sentinel well
	MW-109M	30	20 - 30	X		X	Yes	No	No	Cross-gradient well
	MW-110M	30	20 - 30	X	X	X	No	No	Yes	North source area well
	MW-111M	30	20 - 30	X	X	X	No	No	Yes	South source area well
	MW-112M	30	20 - 30	X		X	No	No	Yes	Upgradient well
Deep	MW-113M	30	20 - 30	X	X	X	No	No	Yes	Performance monitoring south source area
	HD-MW-07M	30	20 - 30	X	X	X	Yes	No	No	Performance monitoring south source area
	MW-102D	60	50 - 60	X		X	Yes	No	No	Cross-gradient well
	MW-104D	60	50 - 60	X		X	Yes	No	No	Down/Cross-gradient well
	MW-105D	60	50 - 60	X	X	X	No	No	Yes	Performance monitoring south source area
	MW-107D	60	50 - 60	X	X	X	Yes	No	No	Performance monitoring north source area
	MW-108D	60	50 - 60	X		X	Yes	No	No	Downgradient sentinel well
	MW-109D	60	50 - 60	X		X	Yes	No	No	Upgradient well
	MW-110D	60	50 - 60	X	X	X	No	No	Yes	North source area well
	MW-111D	60	50 - 60	X	X	X	No	No	Yes	South source area well
Very Deep	MW-112D	60	50 - 60	X		X	No	No	Yes	Upgradient well
	HD-MW-07D	60	50 - 60	X	X	X	Yes	No	No	Performance monitoring south source area
Very Deep	MW-110VD	90	80 - 90			X	No	No	Yes	Verification of very deep groundwater impact well - will abandon if clean

Figures



Environmental Science and Engineering

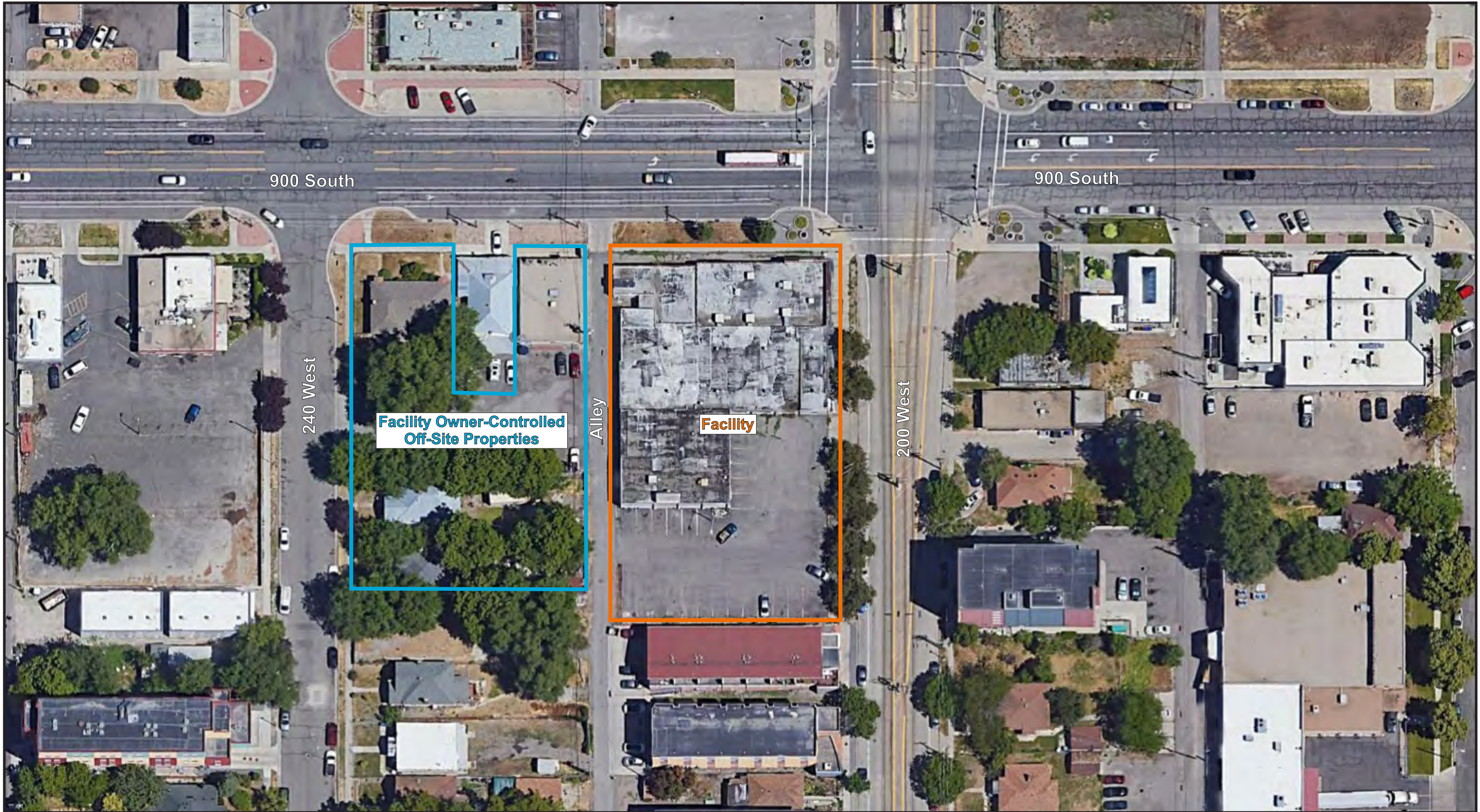
Facility Location Map



Former Henries Dry Cleaner
906 South 200 West
Salt Lake City, Utah, 84101

PROJECT NO.: 2221-003G

DATE: December 3, 2020

FIGURE 1



-  Facility Property Boundary
-  Facility Owner-Controlled Off-Site Properties

Scale: 1" equals
approximately 62'

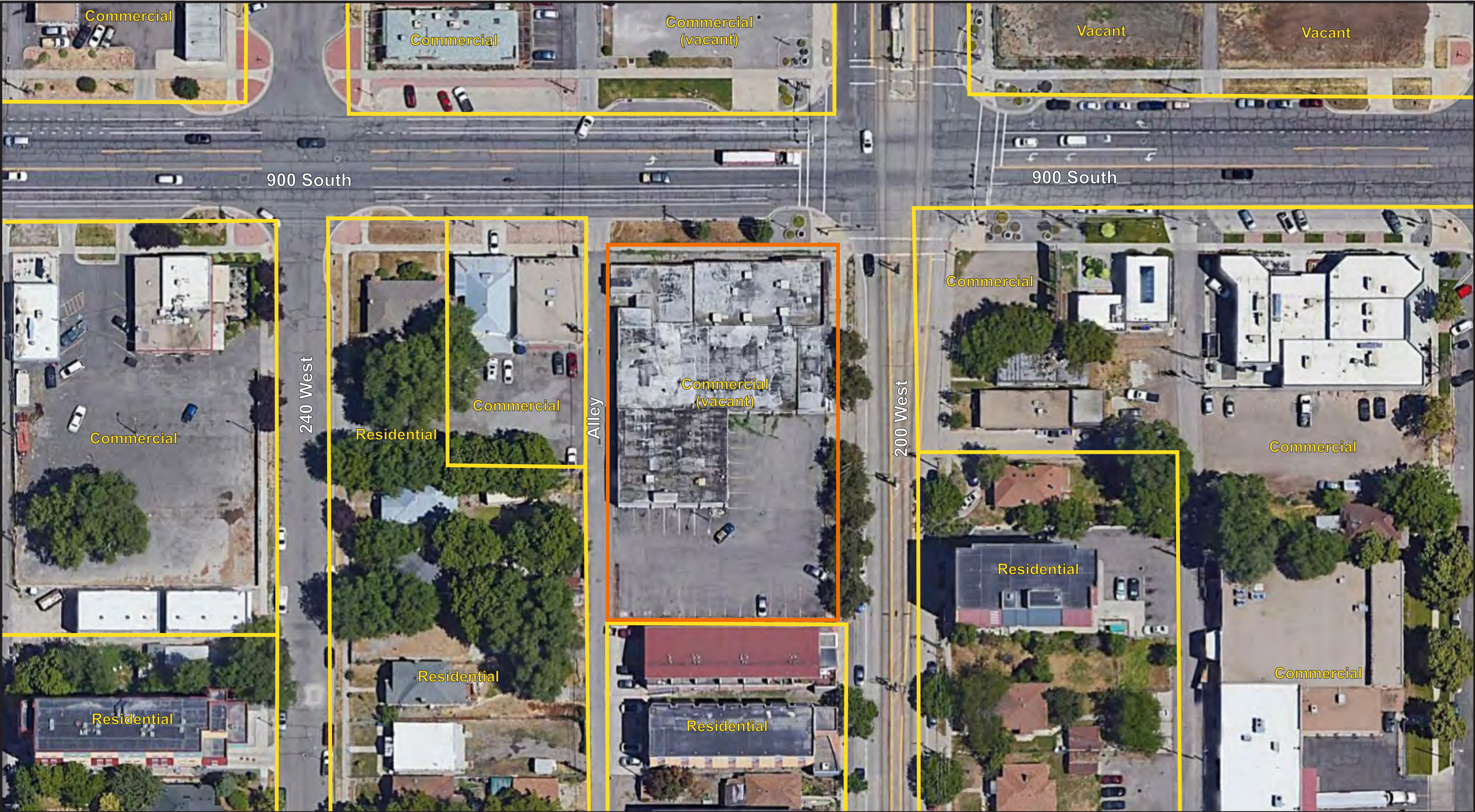






WASATCH
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Redevelopment Area Map		
Former Henries Dry Cleaner 906 South 200 West, Salt Lake City, Utah		
PROJECT NO.	DRAWING DATE	FIGURE
2221-003G	December 3, 2020	2



-  Facility Property Boundary
-  Current Surrounding Land Use

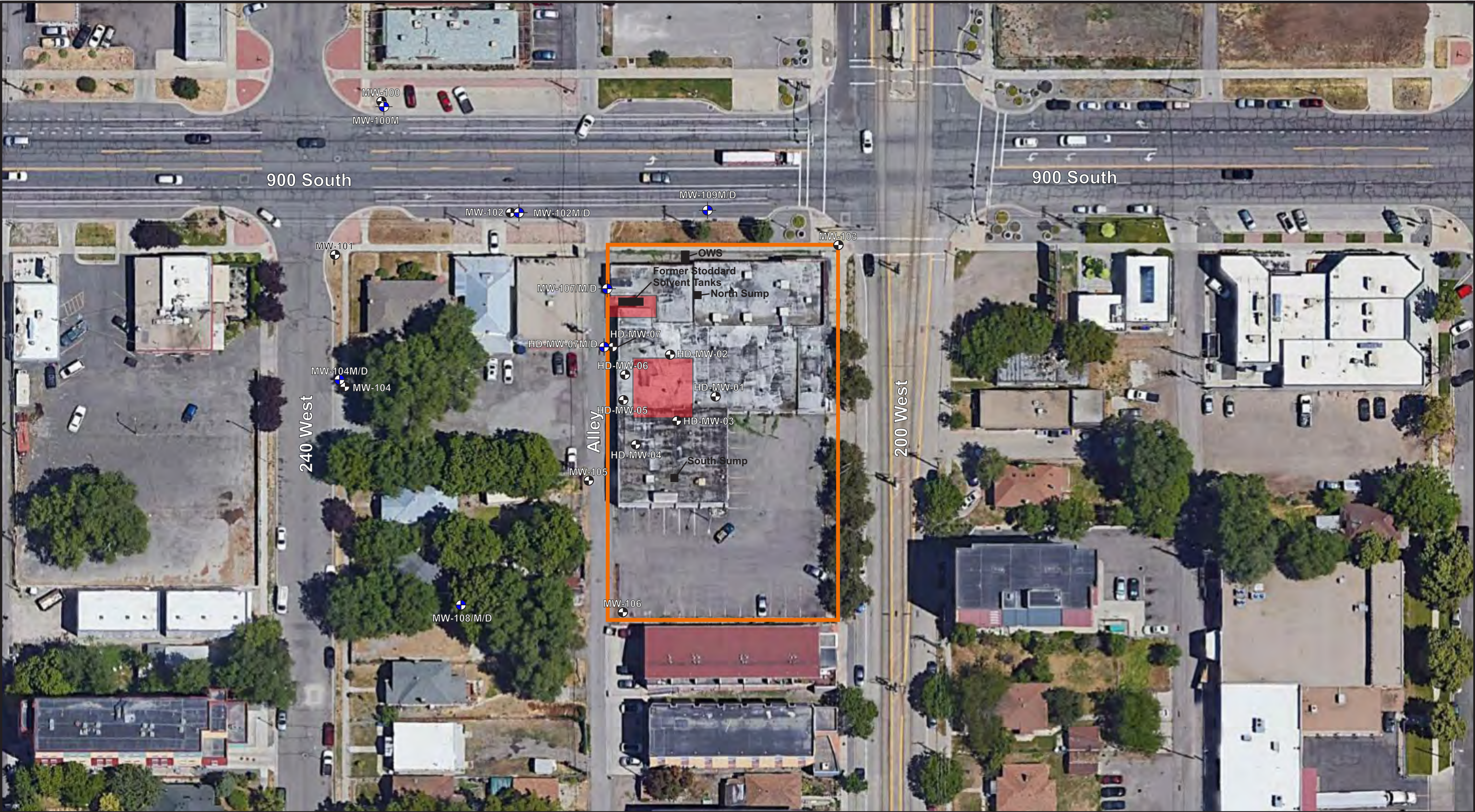
Scale: 1" equals approximately 62'





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Current Property Use Map		
Former Henries Dry Cleaner 906 South 200 West, Salt Lake City, Utah		
PROJECT NO.	DRAWING DATE	FIGURE
2221-003G	December 3, 2020	3



- Previously Installed AECOM Monitoring Well
- Facility Property Boundary
- Source Areas
- Wasatch Installed Monitoring Well

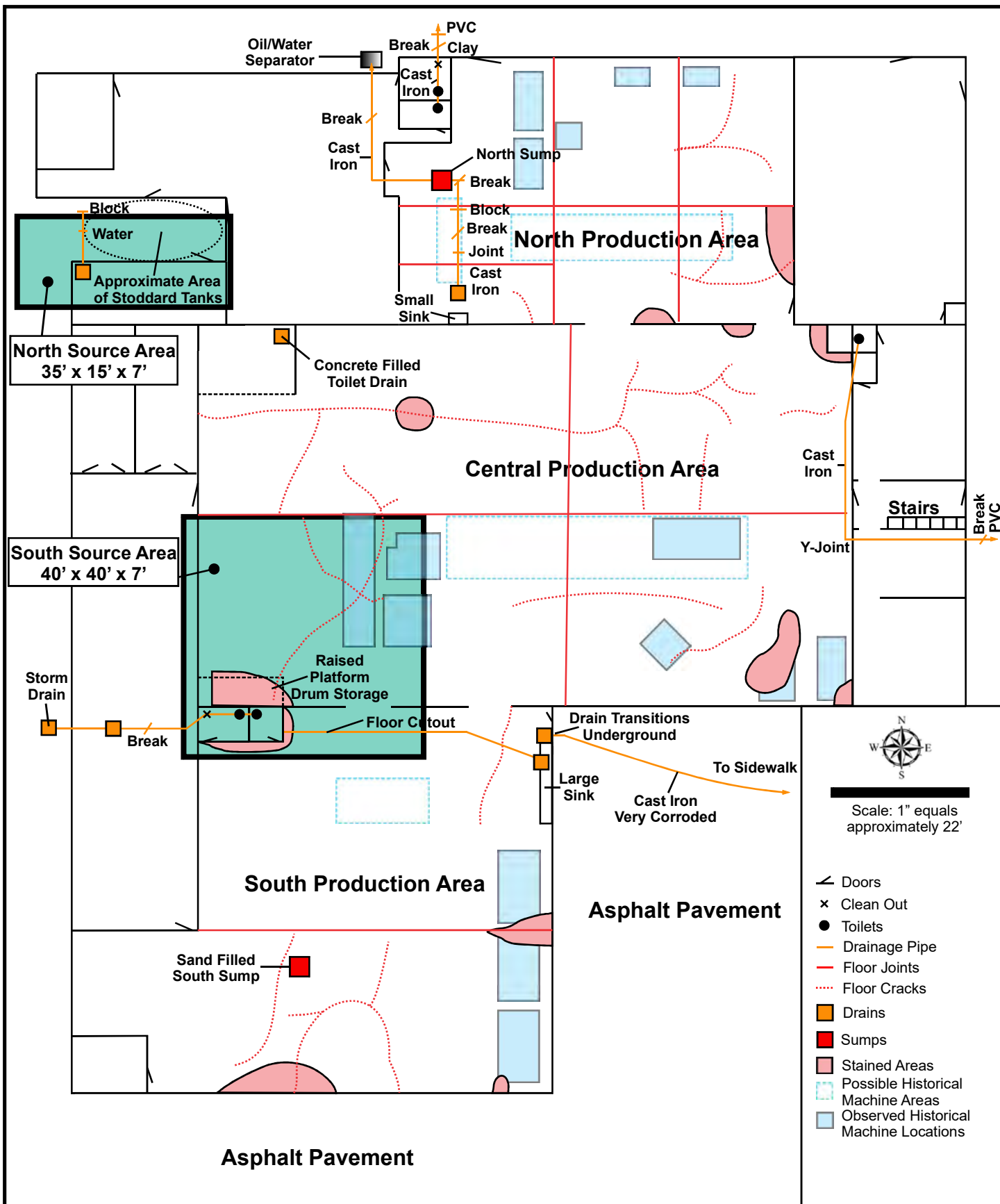
Scale: 1" equals approximately 62'





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Facility Feature Map		
Former Henries Dry Cleaner 906 South 200 West, Salt Lake City, Utah		
PROJECT NO.	DRAWING DATE	FIGURE
2221-003G	December 3, 2020	4



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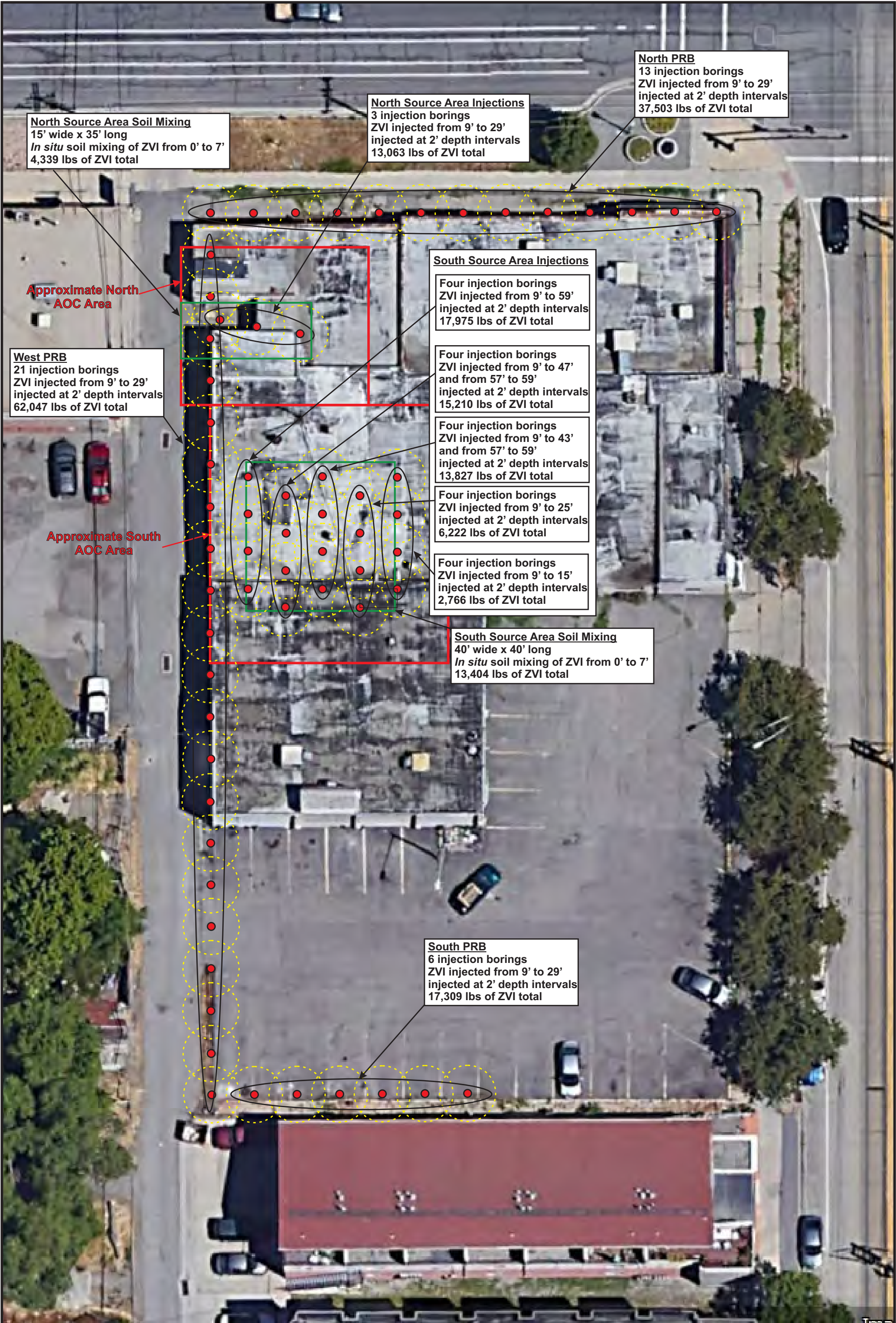
Detailed Facility Feature Map

Former Henries Dry Cleaner
906 South 200 West, Salt Lake City, Utah

PROJECT NO.: 2221-003G

DATE: December 3, 2020

FIGURE 5



North Source Area Soil Mixing
15' wide x 35' long
In situ soil mixing of ZVI from 0' to 7'
4,339 lbs of ZVI total

North Source Area Injections
3 injection borings
ZVI injected from 9' to 29'
injected at 2' depth intervals
13,063 lbs of ZVI total

North PRB
13 injection borings
ZVI injected from 9' to 29'
injected at 2' depth intervals
37,503 lbs of ZVI total

Approximate North
AOC Area

West PRB
21 injection borings
ZVI injected from 9' to 29'
injected at 2' depth intervals
62,047 lbs of ZVI total

Approximate South
AOC Area

South Source Area Injections

Four injection borings
ZVI injected from 9' to 59'
injected at 2' depth intervals
17,975 lbs of ZVI total

Four injection borings
ZVI injected from 9' to 47'
and from 57' to 59'
injected at 2' depth intervals
15,210 lbs of ZVI total

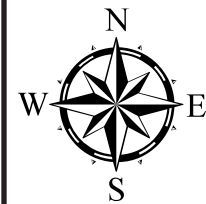
Four injection borings
ZVI injected from 9' to 43'
and from 57' to 59'
injected at 2' depth intervals
13,827 lbs of ZVI total

Four injection borings
ZVI injected from 9' to 25'
injected at 2' depth intervals
6,222 lbs of ZVI total

Four injection borings
ZVI injected from 9' to 15'
injected at 2' depth intervals
2,766 lbs of ZVI total

South Source Area Soil Mixing
40' wide x 40' long
In situ soil mixing of ZVI from 0' to 7'
13,404 lbs of ZVI total

South PRB
6 injection borings
ZVI injected from 9' to 29'
injected at 2' depth intervals
17,309 lbs of ZVI total



Scale: 1-inch equals
approximately 24 feet



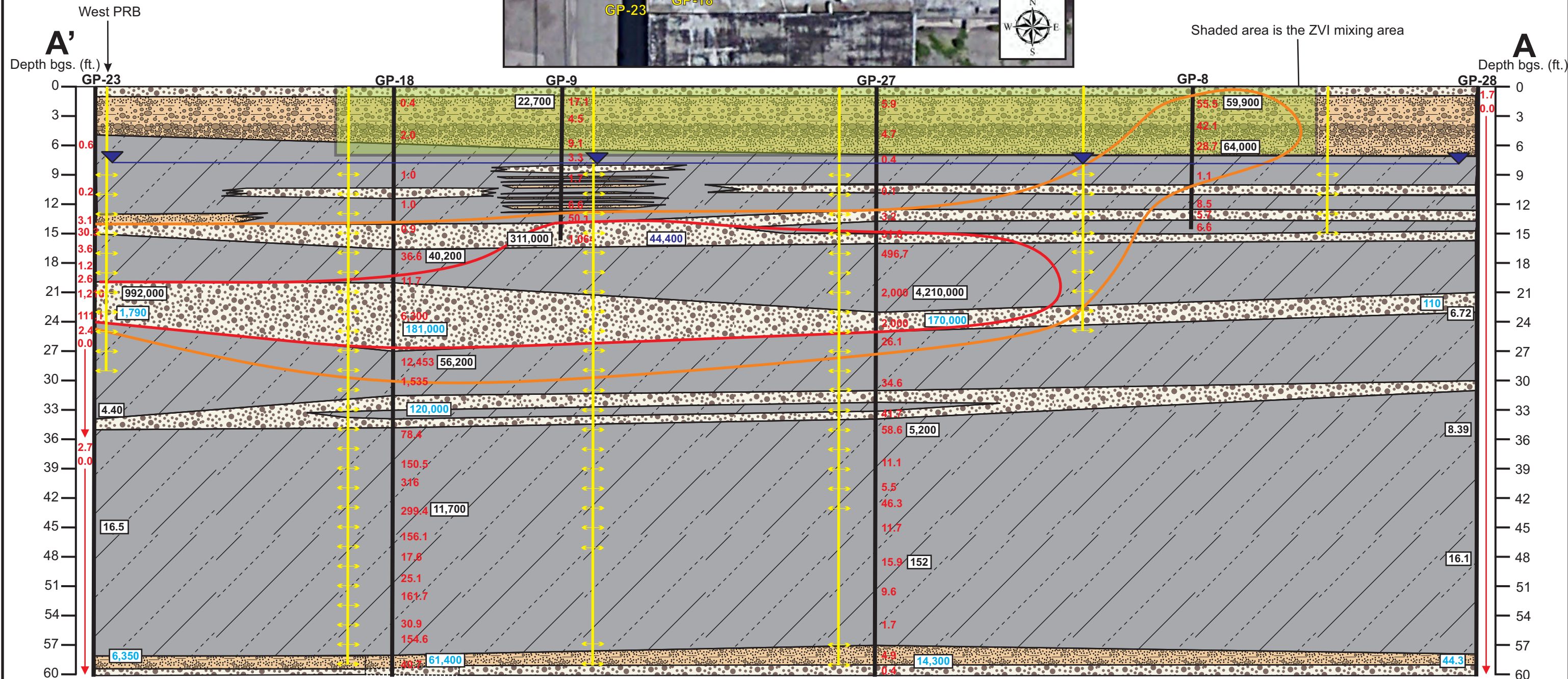
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**Proposed Injection Boring and
Soil Mixing Map**

Former Henries Dry Cleaner
906 South 200 West, Salt Lake City, Utah

PROJECT NO.	DRAWING DATE	FIGURE
2221-003G	December 7, 2020	6



- Silt or Clay
- Silty or Clayey Sand and/or Gravel (greater than 15% fines)
- Sand and Gravels (less than 15% fines)
- ZVI Injection Boring Location and Interval

Scale: 1-inch equals
approximately 4 feet

- XX.X = Photoionization detector reading in parts per million
- XX.X Soil PCE concentration in micrograms per kilogram unless otherwise noted
- XX.X Groundwater PCE concentration in micrograms per liter
- Soil Impacts Above U.S. EPA RSL for PCE in Industrial Soil
- Soil Impacts Above U.S. EPA RSL for PCE in Residential Soil
- Water table

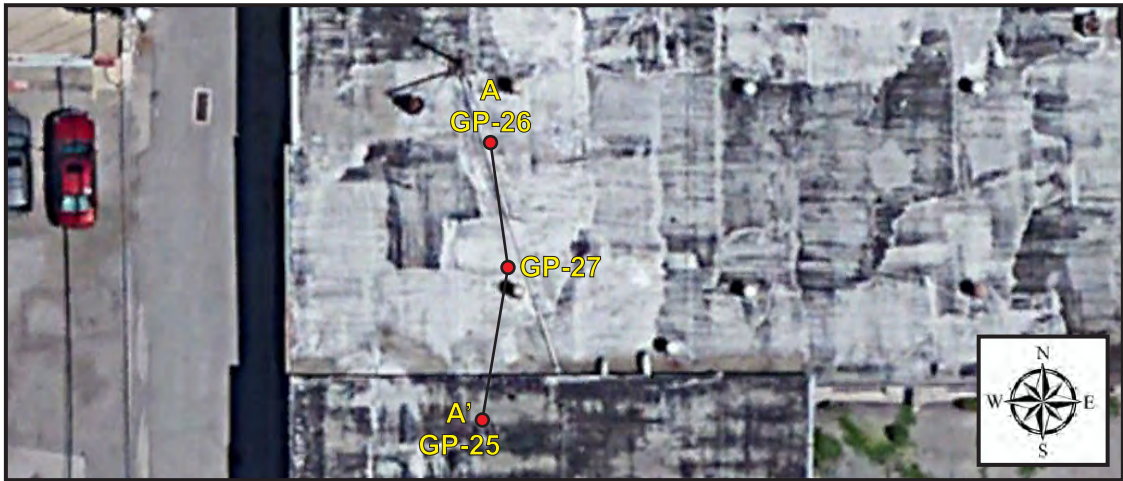
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East/West Hydrogeological Cross-Section

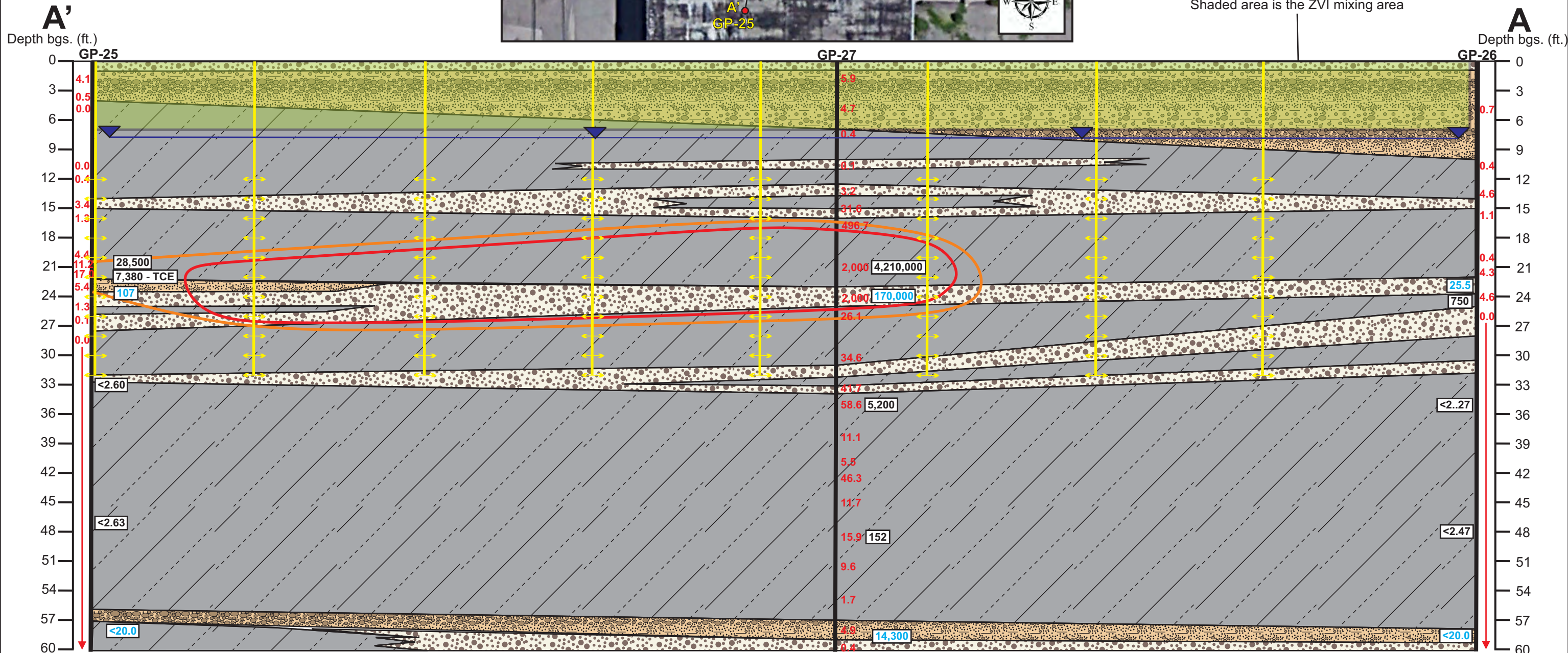
Former Henries Dry Cleaner
906 South 200 West
Salt Lake City, Utah

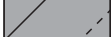




PROJECT NO.	DRAWING DATE	FIGURE
2221-003G	November 23, 2020	7

*Only injection locations located immediately east and west of the cross-section line have been projected into the cross-section below.



Shaded area is the ZVI mixing area



 Silt or Clay	Scale: 1-inch equals approximately 2.9 feet	XX.X = Photoionization detector reading in parts per million	 Environmental Science and Engineering	North/South Hydrogeological Cross-Section		
 Silty or Clayey Sand and/or Gravel (greater than 15% fines)		XX.X Soil PCE concentration in micrograms per kilogram unless otherwise noted		Former Henries Dry Cleaner 906 South 200 West Salt Lake City, Utah		
 Sand and Gravels (less than 15% fines)		XX.X Groundwater PCE concentration in micrograms per liter		PROJECT NO.	DRAWING DATE	FIGURE
 ZVI Injection Boring Location and Interval		Soil Impacts Above U.S. EPA RSL for PCE in Industrial Soil		2221-003G	November 18, 2020	8
		Soil Impacts Above U.S. EPA RSL for PCE in Residential Soil				



Previously Installed AECOM Monitoring Well

Facility Property Boundary

Source Areas

Wasatch Installed Monitoring Well

Proposed Soil Confirmation Sample Location

Proposed Abandoned Monitoring Well

Proposed 80 to 90 Foot Deep Monitoring Well and Intermediate Well

Proposed Shallow, Intermediate, and Deep Monitoring Well

Proposed Shallow Monitoring Well

Proposed Intermediate and Deep Monitoring Well

Proposed Excavation Soil Confirmation Sampling Area

N
W E
S

Scale: 1" equals
approximately 62'

Environmental Science and Engineering

Proposed Confirmation Sampling
and Monitoring Well Plan Map

Former Henries Dry Cleaner
906 South 200 West, Salt Lake City, Utah

PROJECT NO.	DRAWING DATE	FIGURE
2221-003G	December 3, 2020	9

Appendix A
Zero Valent Iron Information



Zero Valent Iron – High quality and purity iron powder and granules for water treatment or conditioning, permeable reactive barriers, and other soil remediation applications.

Benefits Include

Proven remediation technology since 1970's

Applicable in soil piles and insitu applications for groundwater treatment

Economical solution compared to other available products

Can combine with MTS for mixed contaminant plumes with metals and organics

Proven Field Applications

Permeable reactive barriers (PRBs) and Funnel and Gate

Direct Push Injection of micron scale particles into groundwater zone

Trenching and aggregate scale particles PRB design

Deep Soil Mixing

Hydraulic Fracturing

Applicable to Treatment of many contaminants including:

Chlorinated Solvents
PCE, TCE, DCE
And degradation products
Other chlorinated compounds

Heavy Metals

Arsenic
Selenium
Hexavalent Chromium (CrVI)
Other heavy metals

Other COCs

Cyanide
Nitrate
Uranium
Technetium
Pesticides (DDT, DDD, and DDE)

Our Zero valent iron powder is manufactured from 100% recycled virgin iron residual material from trusted OEM manufacturers with iron content up to 99% depending on specification requirements. We use high quality raw materials and proprietary grinding and pulverizing technology to produce ZVI powder with no appreciable surface oxides.



Material

Iron
Carbon
Silicon
Water

% Composition

up to 99%
minimal %
minimal %
less than 1%

Physical Properties

Form: Fine Powder to aggregate
Density: 2.2-3.6 g/cm³
Odor: Odorless
Color: Gray

ZVI Size and Associated Application

ULTRA-FINE ZVI POWDER

MICRO 20 (625 Mesh)

>25 micron	<7%
20-25 micron	>90%
<20 micron	<7%

MICRO 40 (400 Mesh)

>44 micron	<5%
37-44 micron	>90%
<37 micron	<7%

STANDARD ZVI BLEND

MICRO BLEND (+/- 10%)

88-177 micron	30-35%
88 micron	30-35%
44-74 micron	30-35%
<44micron	<5%

Other options available to meet specific design criteria.

We love made to order opportunities. Let us help you!

Technical support and reliable customer service available to all customers.



MATERIAL SAFETY DATA SHEET

POWDER AND GRANULAR IRON

Page 1 of 4

SECTION 1 – MATERIAL IDENTIFICATION AND INFORMATION

Product Name: Cast Iron Aggregate
Formula: Fe
Date: 1 September, 2015

Chemical Family: Metals
CAS No. 7439-89-6
Appearance: Gray color

SECTION 2 – INGREDIENTS AND RECOMMENDED OCCUPATIONAL EXPOSURE LIMITS

Material	CAS No.	Weight %	ACGIH TLV Mg/cu m
Iron	7439-89-6	94-98%	5
Carbon	7440-44-0	<3%	3.5
Silicon	7440-21-3	<2.5%	10
Manganese	7439-96-5	<0.80%	5

SECTION 3 – HAZARDS IDENTIFICATION

Irritant to the skin, eyes and respiratory system.

Inhalation will cause irritation to lungs and mucus membrane. Irritation to eyes will cause watering and redness. Skin irritation may result in redness, itching or inflammation.

SECTION 4 – FIRST AID MEASURES

If inhaled: Keep patient calm, remove to fresh air. Assist in breathing if necessary.
Consult a physician.

If on skin: Wash thoroughly with soap and water. If irritation develops, seek medical attention.

If in eyes: Wash affected eyes for at least 15 minutes under running water with eyelids held open. If irritation develops, seek medical attention.

If swallowed: Rinse mouth and then drink plenty of water. Seek medical attention.

SECTION 5 – FIRE FIGHTING MEASURES

Flash point: Not applicable

Flammability: Non-flammable

Suitable extinguishing media: waterspray

Unsuitable extinguishing media for safety reasons: carbon dioxide

Additional information:

Avoid whirling up the material/product because of the danger of dust explosion.

Protective equipment for fire-fighting:

Firefighters should be equipped with self-contained breathing apparatus and turn-out gear.

Additional information:

The degree of risk is governed by the burning substance and the fire conditions. Contaminated extinguishing water must be disposed of in accordance with official regulations.



SECTION 6 – ACCIDENTAL RELEASE MEASURES

Personal precautions: Avoid dust formation. Use personal protective clothing.

Environmental precautions: This product is not regulated by RCRA. This product is not regulated by CERCLA ('Superfund').

Cleanup: Do not vacuum up powder. For large amounts: Dampen, pick up mechanically and dispose of. For residues: Dampen, pick up mechanically and dispose.

SECTION 7 - HANDLING AND STORAGE

Handling: Handle in accordance with good industrial hygiene and safety practice. Wear suitable personal protective clothing and equipment.

Storage temperature: Ambient temperature

Protection against fire and explosion: Fine dust of the product is capable of dust explosion. Avoid all sources of ignition: heat, sparks, open flame. Electrostatic discharge may cause ignition. Ground all transfer equipment properly to prevent electrostatic discharge.

Storage incompatibility: Segregate from acids and from oxidants.

Storage stability: Protect against moisture.

SECTION 8 – EXPOSURE CONTROLS AND PERSONAL PROTECTION

Personal protective equipment respiratory protection: Wear a NIOSH-certified (or equivalent) particulate respirator. Do not exceed the maximum use concentration for the respirator face piece/cartridge combination.

Hand protection: Chemical resistant protective gloves

Eye protection: Tightly fitting safety goggles (chemical goggles).

General safety and hygiene measures: Handle in accordance with good industrial hygiene and safety practice. Wearing of closed work clothing is recommended.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

Form: Fine Powder to Aggregate

Odor: Odorless

Color: Gray

Vapor Pressure: N/A

Density: 2.4-3.8 g/cm³

Solubility in water: Insoluble

Molar Mass: 55.85 g/mol

SECTION 10 – TOXICOLOGICAL INFORMATION

Acute toxicity

Information on: Carbonyl iron powder Assessment of acute toxicity:
Virtually nontoxic after a single ingestion.

Oral

Information on: Carbonyl iron powder Type of value: LD50 Species: rat
(male) Value: 9,860 mg/kg (OECD Guideline 401)

Repeated dose toxicity

Information on: Iron Information on: Iron Oxide

Carcinogenicity

Information on: Carbonyl iron powder. No data available concerning carcinogenic effects.



SECTION 11 - ECOLOGICAL INFORMATION

Aquatic toxicity: Iron powder Assessment of aquatic toxicity:

There is a high probability that the product is not acutely harmful to aquatic organisms. The inhibition of the degradation activity of activated sludge is not anticipated when introduced to biological treatment plants in appropriate low concentrations.

SECTION 12 - DISPOSAL CONSIDERATIONS

Waste disposal of substance: Dispose of in a licensed facility. Dispose of in accordance with national, state and local regulations.

Container disposal: Contaminated packaging should be emptied as far as possible; then it can be passed on for recycling after being thoroughly cleaned.

SECTION 13 - TRANSPORTATION INFORMATION

Land transport

USDOT- Not classified as a dangerous good under transport regulations

Sea transport

IMDG- Not classified as a dangerous good under transport regulations

Air transport

IATA/ICAO- Not classified as a dangerous good under transport regulations

SECTION 14 – OTHER INFORMATION

We value the health and safety of our employees, customers, suppliers and neighbors, and the protection of the environment. Our commitment to safety is integral to conducting our business and operating our facilities in a safe and environmentally responsible fashion, supporting our customers and suppliers in ensuring the safe and environmentally sound handling of our products.

Disclaimer/ Additional information:

IMPORTANT: WHILE THE DESCRIPTIONS, DESIGNS, DATA AND INFORMATION CONTAINED HEREIN ARE PRESENTED IN GOOD FAITH AND BELIEVED TO BE ACCURATE, IT IS PROVIDED FOR YOUR GUIDANCE ONLY. BECAUSE MANY FACTORS MAY AFFECT PROCESSING OR APPLICATION/USE, WE RECOMMEND THAT YOU MAKE TESTS TO DETERMINE THE SUITABILITY OF A PRODUCT FOR YOUR PARTICULAR PURPOSE PRIOR TO USE. NO WARRANTIES OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE MADE REGARDING PRODUCTS DESCRIBED OR DESIGNS, DATA OR INFORMATION SET FORTH, OR THAT THE PRODUCTS, DESIGNS, DATA OR INFORMATION MAY BE USED WITHOUT INFRINGING THE



MATERIAL SAFETY DATA SHEET

GRANULAR IRON / ZERO VALENT IRON

Page 4 of 4

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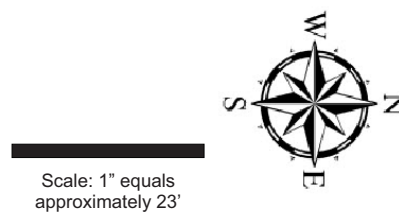
END OF DATA SHEET

Appendix B

Passive Vapor Mitigation System Design



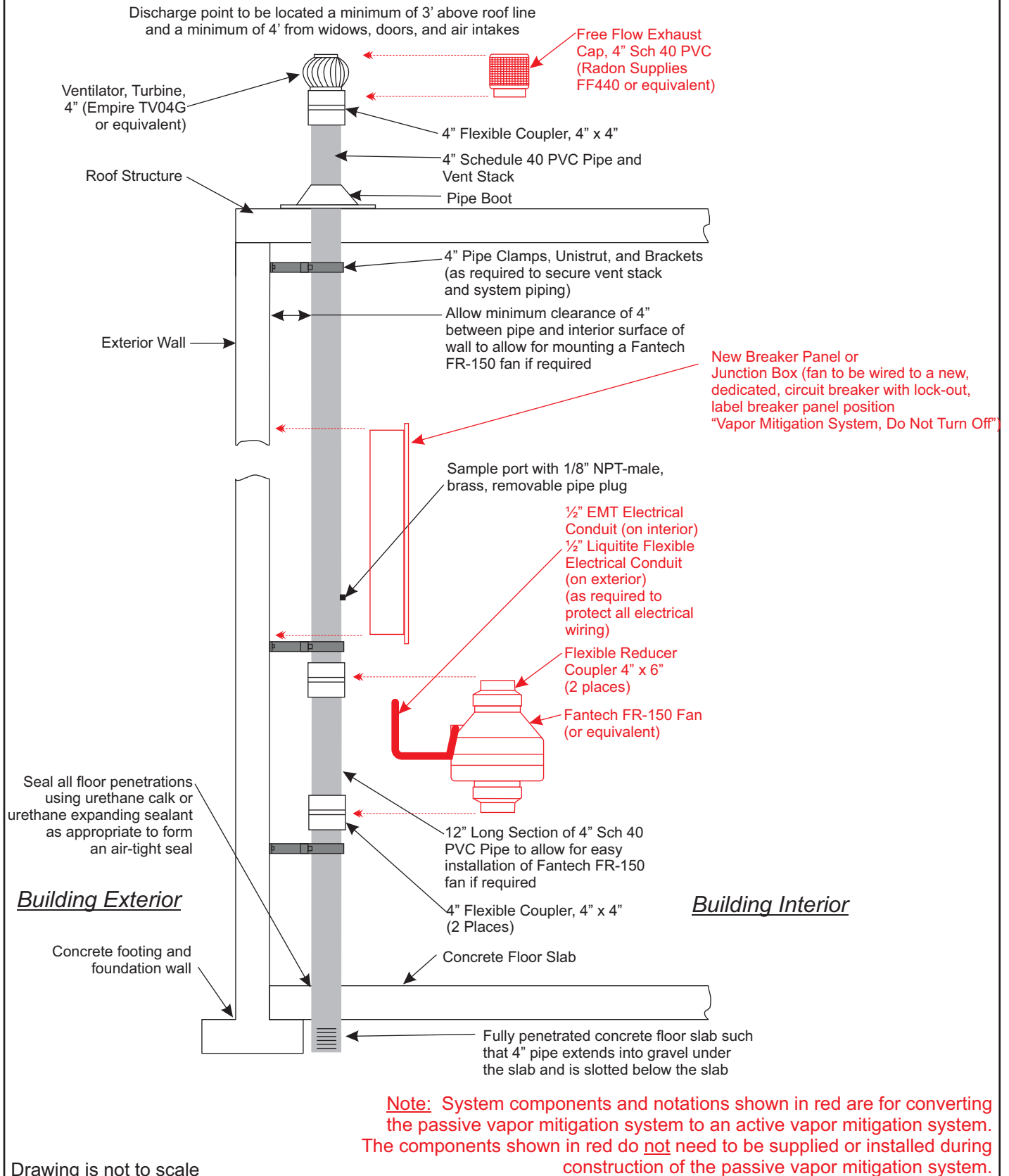
● Proposed Vent Stack Location (Approximate)



Proposed Vent Stack Location Map

Former Henries Dry Cleaner
906 South 200 West, Salt Lake City, Utah

PROJECT NO.	DRAWING DATE	FIGURE
2221-003C	November 7, 2018	B-1



Passive Vapor Mitigation System Design

Figure B-2

Appendix C

Vapor Barrier Specifications and Installation Instructions

COMPLETE PROTECTION

With **Drago's** Full Line of Accessory Products



Drago® Tape

This pressure-sensitive adhesive, coupled with the same uniquely designed materials as Drago Wrap, make it ideal for sealing Drago Wrap seams and penetrations.



DragoTack™ Tape

A solvent-resistant, double-sided adhesive strip used to bond and seal Drago Wrap to concrete, masonry, wood, metal, and other surfaces.



Drago® Sealant

A two-part, water-based, urethane, designed to be used with Drago Wrap, for sealing utility and pipe penetrations.



Drago® Sealant Form

A low-density, cross-linked, closed-cell polyethylene foam designed to be used as a detailing piece with Drago Sealant.



DRAGO® WRAP

VAPOR INTRUSION BARRIER



Engineered protection to create a healthy built environment.

Drago INSTALLATION

Installation methodology derived from extensive lab and field work based on the principles found in ASTM E1643 and validated through pressure stress testing of simulated installations demonstrates **Drago Wrap's** ability to produce a fully intact, dependable installation.

As with any protection system, the installation of **Drago Wrap** is critical to the system's effectiveness. **Drago Wrap** and **Drago Accessories** make it easy to complete a successful installation. Refer to the complete **Drago Wrap Installation Instructions** and **Warranty Information** on the website: www.stegoindustries.com.*



Drago SUPPORT

Our North American network of Stego employees, representatives, and distributors ensure that the products we bring to market are both readily available and accompanied with excellent technical knowledge and field support *when you need it*.*

To learn more about this new game-changing technology, contact us to get in touch with the nearest Stego representative.* We look forward to working with you on your next project.
www.stegoindustries.com | 877-464-7834



Tel: 949-257-4100 | Toll Free: 877-464-7834 | www.stegoindustries.com

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A VAPOR INTRUSION BARRIER SOLUTION with Unsurpassed Permeation Coefficients

Drago Wrap Vapor Intrusion Barrier is a multi-layered plastic extrusion that combines uniquely designed materials with only high grade, prime, virgin resins. This game-changing barrier technology provides high performance and longevity, allowing for the redevelopment of contaminated sites, creating a *healthy* built environment.

3-in-1 product solution A *cost effective* 3-in-1 product solution providing unsurpassed protection from chlorinated solvents, hydrocarbons, and moisture vapor.

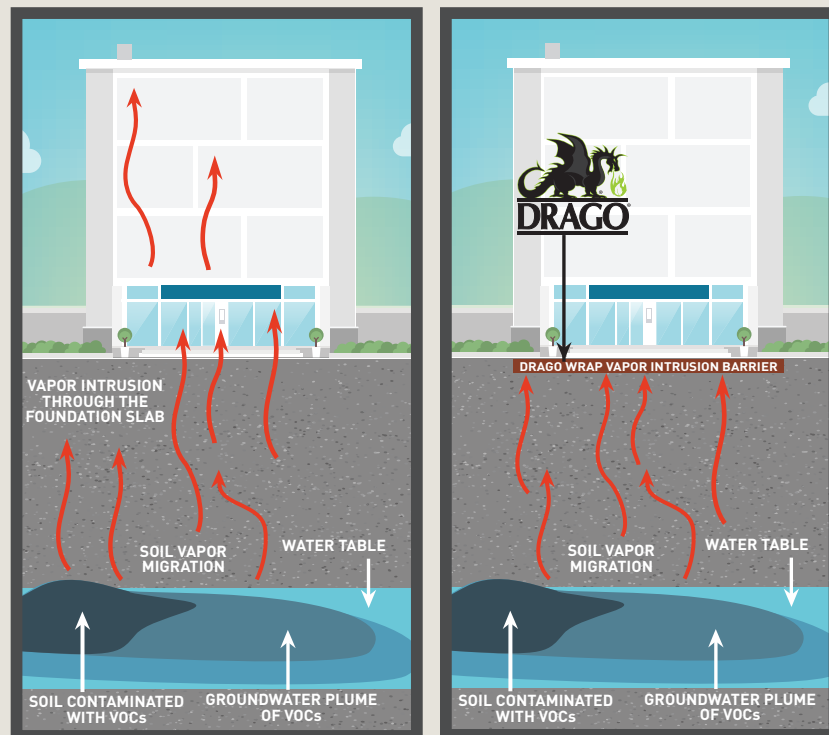
Drago Wrap Vapor Intrusion Barrier is the next game-changing barrier technology from the creators of Stego® Wrap Vapor Barrier, the most widely-specified below-slab moisture vapor barrier in North America.*

"It is estimated that there are more than 450,000 brownfields in the U.S."

– www.epa.gov/brownfields

EXPOSURE PATHWAY – VAPOR INTRUSION

For brownfields and contaminated sites, the focus has historically been to protect human health by preventing exposure to direct contact of contaminated soil or drinking contaminated water. We now know that inhaling chemical vapors poses a potential risk to the health of residents, workers, and other occupants who are inside of the buildings. (Source: EPA)



Vapor-forming chemicals may include:

- Volatile organic compounds (VOCs), such as trichloroethylene and benzene.
- Select semivolatile organic compounds, such as naphthalene.

This exposure pathway, known as vapor intrusion, is the movement of chemical vapors from the soil and groundwater into the building envelope.

- In extreme examples, there is a risk of fire or explosion.
- Other times, at levels with a detectable odor, there may be acute short-term health issues such as nausea, headache, and respiratory irritation.
- More commonly though, long-term exposure to even low-levels of certain chemical vapors may increase the risk of chronic health effects, such as cancer.

(Source: EPA)



Migration of Soil Vapors to Indoor Air

Both diffusion and advection can draw unwanted chemicals into the building envelope. Regardless of the path that soil vapors can take, **experts agree that a monolithic layer of protection like the Drago Wrap Vapor Intrusion Barrier System is critical to controlling the transmission of these chemicals into the building.**



DRAGO WRAP IS
ENGINEERED TO SERVE
AS A **BARRIER** TO
VOLATILE ORGANIC
COMPOUNDS

Drago Wrap is specifically engineered to serve as a barrier to volatile organic compounds (VOCs). Through patented and trade secret processes, **Drago Wrap** combines engineered barrier materials with the *flexibility* and *strength* of a *high-performance* polyolefin film into an *easy-to-install* barrier against hydrocarbons and chlorinated solvents.

BENEFITS OF THE **DRAGO WRAP** VAPOR INTRUSION BARRIER SYSTEM

FEATURES	BENEFITS
Independent, university testing	Efficacy testing for hydrocarbons, chlorinated solvents, and other soil gases (radon, methane)
Made from game-changing resin technology and provides high performance and longevity	Allows Developers, Owners, and Engineers to redevelop brownfield sites and create a healthy built environment
Installation methodology derived from extensive lab and field work based on the principles found in ASTM E1643 and finally validated through pressure stress testing of simulated installations	Fully intact, dependable installation
20-mil, multi-layer material	Exceptional durability as a result of robust physical properties
14 ft wide rolls	Minimize seams
ASTM E1745 compliant	Designed to be installed below concrete slabs in commercial, residential, and industrial applications

✓ Extensive testing TESTED – PROVEN EFFECTIVENESS

Extensive, independent testing proved **Drago Wrap's** effectiveness in attenuating hydrocarbons and chlorinated solvents. For more information on our independent testing, please contact Stego Industries' Technical Department or visit our website at www.stegoindustries.com.*



DRAGO® WRAP VAPOR INTRUSION BARRIER RESISTANCE TO DEGRADATION – ADDITIONAL CONSIDERATIONS

Drago Wrap Vapor Intrusion Barrier, and the technologies that underlie this game-changing vapor intrusion protection product, has undergone extensive testing to determine its ability to attenuate VOCs and other relevant material properties. These tests exposed Drago Wrap to a host of deleterious chemicals that may exist at or below a project site, including various petroleum distillates, chlorinated solvents, etc. The results of these tests are positive and telling; they show that Drago Wrap is extremely impermeable to a wide range of chemical vapors and, more importantly for our current considerations, maintains such impermeability over the course of years of exposure to these deleterious compounds.

While the results of such testing speak extensively to Drago Wrap's ability to resist degradation in extreme exposure conditions, we wished to pursue multiple exposure scenarios to further increase the confidence project team members should have in Drago Wrap as a critical component of the vapor intrusion systems they utilize on their projects. The following pages detail these measures. The conclusions indicate that there were no significant changes in mass or volume of Drago Wrap when exposed to direct contact with soils contaminated with benzene, toluene, ethylbenzene, xylene (collectively known as BTEX), trichloroethylene (TCE), perchloroethylene (PCE, or tetrachloroethylene), cis-1,2-dichloroethylene (C-DCE), trans-1,2-dichloroethylene (T-DCE), and sulfates. Additionally, we tested the post-exposure samples to determine their tensile strength (ASTM E882) and permeance to water vapor (F1249), and we observed that Drago Wrap maintains its ability to meet each corresponding performance threshold for high-performance water vapor barriers: for D882, Drago Wrap remains a Class A Vapor Barrier per ASTM E1745; for F1249, Drago Wrap maintains a permeance well below 0.01 perms.

If additional questions remain regarding any aspect of Drago Wrap, please be sure to contact the Stego Technical Department. We are happy to help and look forward to the opportunity to provide an effective and economical solution to your barrier needs.

Regards,

Dan Marks CSI CDT LEED Green Associate
Technical Director | Stego Industries, LLC
O: (949) 325-2035 | F: (949) 325-2062
danmarks@stegoindustries.com



DRAGO® WRAP VAPOR INTRUSION BARRIER TESTING SIMULATED HYDROCARBON (BTEX) CONDITION

SETUP

To simulate a hydrocarbon contaminated brownfield site, a senior chemist at a research and testing lab prepared contaminated water to contain 1,000 ppb of each benzene, toluene, ethylbenzene, and xylene (BTEX). Two liters of this mixture were placed in a chamber, 49 cm x 23.5 cm wide by 27 cm tall. ASTM C778 standard 20-30 sand was added to the vessel until it was 5 cm above the original water line. At this level, the sand was damp with no free-standing water. Drago Wrap samples were placed on top of the damp sand, and the entire surface of the membrane were weighted down with sand-filled plastic bags to ensure full contact of the Drago Wrap with the damp sand. The test vessel was covered and sealed. After 30 days of exposure under ambient laboratory conditions (21-25°C), the samples were removed for evaluation.

Simply stated:

We took relatively large amounts of often-seen hydrocarbons resulting from fuel spills and old service station sites and put them into a water table just 2 inches below a sample of Drago Wrap. This can be considered an extreme situation in that water tables are not typically that close to the slab and vapor barrier membrane. After a 30-day exposure, the mass and volume changes were analyzed, and we subsequently tested the material for its water vapor permeance rating and tensile strength.

RESULTS

Mass and Volume

The chemist conducted mass and volume measurements before and after exposure. The following comes directly from her report: *"All of the test coupons exhibited slight changes in mass and volume, no matter what their exposure conditions were. Statistical analysis by the two-tailed t-test showed that the changes for the BTEX-exposed coupons were not significantly different from the changes for the control-exposed coupons."*

Conclusion: In other words, Drago Wrap mass and volume were not significantly affected by the BTEX exposure.

Tensile Strength

Samples were sent by the lab to our in-house lab and tested per ASTM E882 in both the machine and transverse directions. After the 30-day extreme BTEX solvent exposure, the results were 50.2 lbf/in and 49.6 lbf/in for machine and transverse directions respectively. These results were not significantly different than the water-exposed control samples (48.7 lbf/in, 48.5 lbf/in) or the unexposed samples (48.5 lbf/in, 46.8 lbf/in). For another point of comparison, consider that to be labeled as Class A per ASTM E1745, new-material tensile need only test at 45 lbf/in.

Conclusion: BTEX exposure has little to no effect on Drago Wrap's physical integrity in below-slab applications.

Water Vapor Permeance

The testing lab then sent exposed and control samples to our in-house lab where they were subsequently tested per ASTM F1249. The results were very positive. The permeance of the sample exposed to the BTEX solution (0.00733 perms) increased minimally compared to the control (0.00614 perms), both staying well below the threshold of 0.01 perms.

Conclusion: BTEX exposure had minimal effect on Drago Wrap's ability to retard water vapor.



DRAGO® WRAP VAPOR INTRUSION BARRIER TESTING SIMULATED CHLORINATED SOLVENT CONDITION

SETUP

To simulate a dry-cleaning brownfield site, a senior chemist at a research and testing lab prepared contaminated water to contain 3,600 ppb perchloroethylene (PCE), 12,500 PPB trichloroethylene (TCE), 16,200 PPB CIS-1,2-dichloroethylene (C-DCE), AND 1,700 PPB trans-1,2-dichloroethylene (T-DCE). Two liters of this mixture were placed in a chamber, 49 cm x 23.5 cm wide and 27 cm tall. ASTM C778 standard 20-30 sand was added to the vessel until it was 5 cm above the original water line. At this level, the sand was damp with no free-standing water. Drago Wrap samples were placed on top of the damp sand, and the entire surface of the vapor barrier was weighted down with sand-filled plastic bags to ensure full contact of the Drago Wrap with the damp sand. The test vessel was covered and sealed. After 30 days of exposure under ambient laboratory conditions (21-25°C), the samples were removed for evaluation.

Simply stated:

We took an actual soils report from an old dry cleaning site and recreated the conditions, roughly. In the actual scenario the water table was 20 feet below the vapor barrier. In our setup, we created a contaminated water table just 2 inches below Drago Wrap. After a 30-day exposure, the mass and volume changes were analyzed, and we subsequently tested the material for its water vapor permeance rating and tensile strength.

RESULTS

Mass and Volume

The chemist conducted mass and volume measurements before and after exposure. The following comes directly from her report: *"All of the test coupons exhibited slight changes in mass and volume, no matter what their exposure conditions were. Statistical analysis by the two-tailed t-test showed that the changes for the chlorinated solvent-exposed coupons were not significantly different from the changes for the control-exposed coupons."*

Conclusion: Drago Wrap's mass and volume were not significantly affected by the chlorinated solvent exposure.

Tensile Strength

Samples were sent by the lab to our in-house lab and tested per ASTM E882 in both the machine and transverse directions. After the 30-day extreme chlorinated solvent exposure, the results were 51.2 lbf/in and 49.7 lbf/in for machine and transverse directions respectively. These results were not significantly different than the water-exposed control samples (48.7 lbf/in, 48.5 lbf/in) or the unexposed samples (48.5 lbf/in, 46.8 lbf/in). For another point of comparison, consider that to be labeled as Class A per ASTM E1745, new-material tensile need only test at 45 lbf/in.

Conclusion: Chlorinated solvent exposure has little to no effect on Drago Wrap's physical integrity in below-slab applications.

Water Vapor Permeance

The testing lab then sent exposed and control samples to our in-house lab where they were subsequently tested per ASTM F1249. The results were very positive. The permeance of the sample exposed to the BTEX solution (0.00713 perms) increased minimally compared to the control (0.00614 perms), both staying well below the threshold of 0.01 perms.

Conclusion: Chlorinated solvent exposure had minimal effect on Drago Wrap's ability to retard water vapor.



DRAGO® WRAP VAPOR INTRUSION BARRIER TESTING

SIMULATED SULFATE EXPOSURE CONDITION

SETUP

To simulate the worst possible sulfate exposure, a senior chemist at a research and testing lab prepared water contaminated with 10,000 PPM of SO₄ (sulfate.) This sulfate concentration was chosen because it was rated as “very severe” (the highest or worst classification) by UC Berkeley professors conducting research for the Caltrans Long Life Pavement Rehabilitation Strategy (LLPRS) Program. The Chemist took this worst-case scenario concentration and soaked samples of Drago Wrap in it for 28 days. Upon removal, the samples were analyzed for changes in mass and volume, and subsequently the exposed product was tested to determine its tensile strength and water vapor permeance rate.

RESULTS

Mass & Volume

The chemist conducted mass and volume measurements before and after exposure. The following comes directly from her report: *“All of the test coupons exhibited slight changes in mass and volume, no matter what their exposure conditions were. Statistical analysis by the two-tailed t-test showed that the changes for the sulfate-exposed coupons were not significantly different from the changes for the control-exposed coupons.”*

Conclusion: In other words, Drago Wrap’s mass and volume were not significantly affected by the sulfate exposure.

Tensile

Samples were sent by the lab to our in-house lab and tested per ASTM E882 in both the machine and transverse directions. After the 28-day extreme sulfate exposure, the results were 49.6 lbf/in and 52.3 lbf/in for machine and transverse directions respectively. These results were not significantly different than the water-exposed control samples (48.7 lbf/in, 50.8 lbf/in) or the unexposed samples (48.5 lbf/in, 46.8 lbf/in). For another point of comparison, consider that to be labeled as Class A per ASTM E1745, new-material tensile need only test at 45 lbf/in.

Conclusion: Sulfate exposure has little to no effect on Drago Wrap’s physical integrity in below-slab applications.

Water Vapor Permeance

The testing lab then sent exposed and control samples to our in-house lab where they were subsequently tested per ASTM F1249. The results were very positive. The permeance of the sample exposed to the sulfate solution (0.00734 perms) increased minimally compared to the control (0.00698 perms), both staying well below the threshold of 0.01 perms.

Conclusion: Sulfate exposure had no significant effect on Drago Wrap’s ability to retard water vapor.



DRAGO® WRAP VAPOR INTRUSION BARRIER

SUMMARY OF PERMEATION AND ATTENUATION TESTING

BACKGROUND

Commencing in 2015 and continuing indefinitely, Drago Wrap Vapor Intrusion Barrier has been subjected to a series of permeation tests. This testing was designed—and has been subsequently overseen—by an expert in the permeation of volatile organic compounds (VOCs) at a prominent university. The results of this testing have been used to empirically determine the attenuation efficacy (i.e. the permeation coefficients) of Drago Wrap against various hydrocarbons and chlorinated solvents. The purpose of this document is to summarize and explain the robust and ongoing testing protocol utilized and to relay the current results.

CHEMICALS TESTED

Drago Wrap has been/is being tested with regard to permeation of the following chemicals: TCE; PCE; the BTEX family: Benzene, Toluene, Ethylbenzene, Xylene; Dichloromethane; 1,4 Dichlorobenzene; Methyl tert-butyl ether (MTBE) and Naphthalene.

TESTING METHODOLOGY

The tests utilize stainless steel diffusion cells as depicted in Figures 1 and 2. The diffusion cells create two chambers—a source chamber and receptor chamber—that are separated by the membrane under investigation. The source chamber is populated by the permeant (chemical) under consideration and diffuses across the membrane toward the receptor chamber. In this setup, the membrane—Drago Wrap—is the only barrier preventing chemicals from reaching the receptor chamber. Periodic sampling of both the source and receptor chambers of the diffusion cell allows for Gas Chromatography, Mass Spec (GC/MS) analysis of the airspace on either side of the membrane. Complex physics, mathematics and numerical modeling of the GC/MS data yield the permeation coefficients seen in Table 1. Testing, as alluded, is ongoing; the concentrations in the diffusion cells will be monitored indefinitely, numerical models utilized and results updated accordingly.



Figure 1

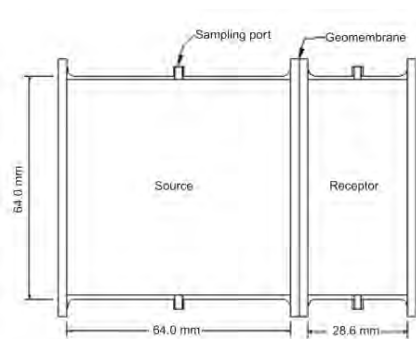


Figure 2

Stego is involved in the research, design, development, production and distribution of the highest quality construction products in the industry. Stego's technical department offers technical advice and additional information regarding the specific properties of all Stego products. Based on the department's experience, understanding of relevant scientific principles, and knowledge of current industry expert recommendations, Stego can advise on issues related to utility versus cost in order to assist in creating installation best practices. However, Stego does not employ design professionals. Therefore, Stego cannot interpret ASTM installation standards (E1643) and must defer to the project's assigned design professional on final design decisions. Version 1.1 | Last Update: October 25, 2017 | Created: September 12, 2017

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DRAGO® WRAP VAPOR INTRUSION BARRIER

SUMMARY OF PERMEATION AND ATTENUATION TESTING

The discrete layers that make up Drago Wrap were tested to determine their respective permeation coefficients. The results obtained from the mathematical modeling of these tests do not necessarily equate to the values obtained from whole-film permeation testing. In other words, the membrane appears to benefit from a synergistic effect; the whole is greater than the sum of its parts. The results in Table 1 come from the most conservative approach to analyzing the results and do not take into account these synergies.

RESULTS

The values displayed in Table 1 result from a combination of data generated from several phases of testing and numerical modeling.

Table 1

Chemical	Abbreviation	Family	Use	Upper-Bound Permeation, P_g [x 10 ⁻¹³ m ² /s]
Benzene	Btex	Aromatic Hydrocarbon	Gasoline byproduct	4.5
Toluene	bTex	Aromatic Hydrocarbon	Gasoline byproduct	5.1
Ethylbenzene	btEx	Aromatic Hydrocarbon	Gasoline byproduct	3.1
M&P-Xylenes	bteX	Aromatic Hydrocarbon	Gasoline byproduct	2.9
O-Xylene	bteX	Aromatic Hydrocarbon	Gasoline byproduct	2.7
Methyl tert-butyl ether	MTBE	Oxygenate	Octane-increasing additive to fuel	0.012
Trichloroethylene	TCE	Chlorinated Hydrocarbon	Dry Cleaning and Solvent	1.5
Tetrachloroethylene	PCE	Chlorinated Hydrocarbon	Dry Cleaning and Solvent	3.0
Dichloromethane	DCM	Chlorinated Hydrocarbon	Paint Stripper, Decaffeinator, Aerosol propellant	4.5
1,4-Dichlorobenzene	1,4-DCB	Chlorinated Hydrocarbon	Pesticide, Disinfectant, Deodorant	7.1
Naphthalene	Naphthalene	Polycyclic Aromatic Hydrocarbon	Fumigant, Pyrotechnics, Wetting Agent	0.25

Stego is involved in the research, design, development, production and distribution of the highest quality construction products in the industry. Stego's technical department offers technical advice and additional information regarding the specific properties of all Stego products. Based on the department's experience, understanding of relevant scientific principles, and knowledge of current industry expert recommendations, Stego can advise on issues related to utility versus cost in order to assist in creating installation best practices. However, Stego does not employ design professionals. Therefore, Stego cannot interpret ASTM installation standards (E1643) and must defer to the project's assigned design professional on final design decisions. Version 1.1 | Last Update: October 25, 2017 | Created: September 12, 2017

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UNDER-SLAB VAPOR INTRUSION BARRIER

PART 1 – GENERAL

1.1 SUMMARY

- A. Products supplied under this section:
 - 1. Vapor intrusion barrier and accessories for installation under concrete slabs.
- B. Related sections:
 - 1. Section 03 30 00 Cast-in-Place Concrete
 - 2. Section 07 26 00 Vapor Retarders

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM E1745-17 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
 - 2. ASTM E1643-11 Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
- B. Technical Reference - American Concrete Institute (ACI):
 - 1. ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.
 - 2. ACI 302.1R-15 Guide to Concrete Floor and Slab Construction.

1.3 SUBMITTALS

- A. Quality control/assurance:
 - 1. Summary of test results per paragraph 9.3 of ASTM E1745.
 - 2. Summary of independent testing documenting permeation testing for hydrocarbons and chlorinated solvents.
 - 3. Manufacturer's warranty.
 - 4. Manufacturer's samples and literature.
 - 5. Manufacturer's installation instructions for placement, seaming, penetration prevention and repair, perimeter seal, and any additional procedures to account for vapor intrusion.
 - 6. All mandatory ASTM E1745 testing must be performed on a single production roll per ASTM E1745 Section 8.1.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Vapor intrusion barrier products:
 - 1. Drago Wrap Vapor Intrusion Barrier by Stego Technology LLC, (877) 464-7834 www.stegoindustries.com.
 - 2. No substitutions.

2.2 ACCESSORIES

- A. Seams:
 - 1. Drago Tape by Stego Technology LLC, (877) 464-7834 www.stegoindustries.com.
- B. Sealing Penetrations of Vapor Intrusion Barrier:
 - 1. Drago Sealant by Stego Technology LLC, (877) 464-7834 www.stegoindustries.com.
 - 2. Drago Sealant Form by Stego Technology LLC, (877) 464-7834 www.stegoindustries.com.
 - 3. Drago Tape by Stego Technology LLC, (877) 464-7834 www.stegoindustries.com.
- C. Perimeter/edge seal:
 - 1. DragoTack Tape by Stego Technology LLC, (877) 464-7834 www.stegoindustries.com.

- D. Penetration Prevention:
 - 1. Beast Foot by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
- E. Vapor Barrier-Safe Screed System
 - 1. Beast Screed by Stego Industries, LLC, (877) 464-7834 www.stegoindustries.com.
 - 2. Beast Hook by Stego Industries, LLC, (877) 464-7834 www.stegoindustries.com.

PART 3 – EXECUTION

3.1 PREPARATION

- A. Ensure that subsoil is approved by Architect or Geotechnical Engineer.
 - 1. Level and compact base material.

3.2 INSTALLATION

- A. Install vapor barrier in accordance ASTM E1643 and manufacturer's instructions.
 - 1. Unroll Drago Wrap with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible. Drago Wrap must be installed with the gray side facing the subgrade.
 - 2. Extend Drago Wrap to the perimeter of the slab. If practicable, terminate it at the top of the slab, or terminate at impediments such as dowels, waterstops, or any other site condition requiring early termination of the vapor barrier. Consult the structural engineer and environmental engineer of record before proceeding. At the point of termination, seal Drago Wrap to the foundation wall or grade beam.
 - 3. Seal Drago Wrap along its terminating edge to the entire perimeter wall or footing/grade beam with double sided DragoTack Tape per manufacturer's instructions. Ensure the concrete is clean and dry prior to adhering tape.
 - 3. Overlap joints a minimum of 12 inches and seal with Drago Tape.
 - 4. Apply Drago Tape to a clean and dry Drago Wrap.
 - 5. Seal all penetrations per manufacturer's instructions.
 - 6. For interior forming applications, avoid the use of non-permanent stakes driven through vapor barrier. Use blunt-end and/or threaded nail stakes (screed pad posts) and insert them into Beast Foot. Ensure Beast Foot's peel-and-stick adhesive base is fully adhered to Drago Wrap.
 - 7. If non-permanent stakes must be driven through Drago Wrap, repair per manufacturer's instructions.
 - 8. Use reinforcing bar supports with base sections that eliminate or minimize the potential for puncture of Drago Wrap.
 - 9. Repair damaged areas by cutting patches of Drago Wrap, overlapping damaged area a minimum of 6 inches, and taping all sides with Drago Tape.
 - 10. For vapor barrier-safe concrete screeding applications, install Beast Screed (vapor barrier-safe screed system) per manufacturer's instructions prior to placing concrete.

END OF SECTION

Appendix D

Critical Procedures for Zero Valent Iron Injections



JANUARY, 2017
V1.R2

CRITICAL PROCEDURES – LOADING MIXING TANKS WITH A FORKLIFT

A forklift (or lift truck) may be required to load the EF9300 when frac sand or amendments come in containers that are too heavy to be lifted by hand. Anyone operating the forklift or lift truck must have a valid forklift operator certificate from an accredited organization and must be competent with the machine they are operating. A seatbelt must be worn at all times when operating any forklift or lift truck. Due to the increased likelihood of exposure to the treatment amendment particulate matter being loaded, the operator must wear the appropriate personal protective equipment (i.e. eye and respiratory protection) as per the MSDS and manufacturer's specifications.

The EF9300 has been outfitted with a railing and catch-bar system that was designed to prevent crushing hazard during EF9300 tank loading. The railing system increases the lift height required by approximately 50 cm (20 inches). The minimum lift height required for forklifts on fracturing projects is 4.1 m (160 inches). The minimum load rating for forklifts on fracturing projects is 2,270 kg (5,000 lbs). The drive system, tire type and load rating should be considered for sites that may require extra heavy lifting, rough terrain or sites that are sensitive to surface disturbance.

TOOLS

Retractable knife
Wheel chocks

Additional PPE required beyond standard oilfield PPE¹

None, although the nature of the reagents being blended may warrant additional PPE

INSTRUCTIONS

1. Perform a forklift inspection prior to operation at the start of the work day.
2. Clear obstructions pathway between amendment staging area and frac unit.
3. Erect and secure the tank loading guards.
4. Load the amendment onto the forklift via the lifting points or on the pallet. Secure super sacs with a bar and straps if there is an internal plastic membrane.

¹ Standard Oilfield PPE comprises the following:
Fire Retardant Coveralls with high visibility striping
Hardhat
Safety Glasses
Work gloves
Steel-toed boots

5. Bring the amendment to the mixing tank, raise the load as close to the frac unit as possible. Have the frac unit operator guide the container to the desired location. Use wheel chocks to prevent the forklift from contacting the frac unit.
6. Lift and open sand/amendment according to container and manufacturer's instructions.
7. Once the amendment has been loaded, return to the staging area, discard of used container and repeat steps 3 to 5.

TASK DETAILS

Generally two people can load the frac unit under most circumstances however in multiple tank fracturing events and continuous pumping; three or more people are required to expedite loading and staging of amendments. Only the frac unit operator should give directions to the forklift operator when near the frac unit.

SEE NEXT PAGE FOR RISK ASSESSMENT MATRIX



JANUARY, 2017
V1.R2

CRITICAL PROCEDURE – LOADING AND BLENDING SLURRIES

The EF9300 is outfitted with hopper style mixing tanks which are used to batch mix treatment and sand slurries. Treatment amendment and frac sand can come in a variety of containers (i.e. buckets, bags, super sacs etc.) and an appropriate loading process must be used to minimize heavy lifting, fatigue and crush or pinch point hazards. It is important to note that crystalline silica and other solid phase amendments have respirable dust particles that are known to have carcinogenic effects so properly fitted respiratory protective equipment are required when handling and loading any amendment that poses a risk for respiratory exposure. Before loading or handling any treatment amendment, the MSDS must be read and personal protective equipment must meet the manufacturer's specifications. When blending fracturing slurries with particulate or granular treatment reagents refer to Manufacturer's blending instructions, in addition to ***Geo Tactical's RPE Code of Practice and Fit Testing Standards (2016)***. When blending silica sand fracturing slurries refer to ***Geo Tactical's Silica Dust Code of Practice (2016)***, in addition to ***Geo Tactical's RPE Code of Practice and Fit Testing Standards (2016)***.

SUPPLIES

pH strips
Plastic beakers

TOOLS

Retractable knife

Additional PPE required beyond standard oilfield PPE¹

Nitrile gloves
Splash goggles
Fit-Tested Respiratory Protective Equipment (RPE)² with P100 particulate filter cartridges

¹ Standard Oilfield PPE comprises the following:
Fire Retardant Coveralls with high visibility striping
Hardhat
Safety Glasses
Work gloves
Steel-toed boots

² Fit Testing Standards can be found in Geo Tactical's Code of Practice Library – ***GEO TACTICAL RPE CODE OF PRACTICE & FIT TESTING STANDARDS 2016 V1R2***

INSTRUCTIONS

1. Prior to loading any sand³/amendment ensure nitrile gloves, fit-tested RPE and splash goggles (at a minimum) are on.
2. Erect and secure the tank loading guards.
3. Ensure proper base fluid volume and consistency are in tanks, augers are engaged and that the grate is securely fastened down. (No objects should be on top of the grate!)
4. Make certain other workers in the dust area⁴ are wearing appropriate PPE (i.e. respiratory protection).
5. Lift and open sand/amendment according to container and manufacturer's instructions.
6. If loading from super sacs be aware of overhead hazards, do not keep arms and hands underneath loads except to open the container (use a retractable blade knife if required).
7. Dispose of empty containers appropriately (wear the same PPE as loading).

TASK DETAILS

Generally done with two people operating the EF9300. At least one certified person is required to operate the lifting equipment, in some instances two people are necessary (i.e. super sacs requiring preparation). Watch wind direction for dusting hazard, workers not in the immediate working zone may be exposed to particulate matter. Industrial hygiene monitoring has shown that operators and on site personnel of the EF9300 may be exposed to dust particulate within 12 m of the fracturing unit. Extended unprotected occupancy of the 12 m perimeter, particularly downwind of the tanks should be avoided.

SEE NEXT PAGE FOR RISK ASSESSMENT MATRIX

³ If fracturing with silica sand standards outlined in Geo Tactical's Silica Dust Code of Practice must be adhered to - *SILICA DUST CODE OF PRACTICE 2016 V1R2*

⁴ The dusting area will be subject to site specific conditions – use Certified Industrial Hygiene Consulting Ltd. report as reference - *FracRiteExposureJune2011ReportFINAL*



MAY, 2018
V1.R3

CRITICAL PROCEDURE – ENVIRONMENTAL FRACTURING WITH THE EF9300

Hydraulic fracturing involves downhole emplacement of slurry phase treatment amendments and proppants for in situ remediation. Geo Tactical's EF9300 hydraulic fracturing unit is a skid mounted piece of equipment containing two hydraulically driven triplex pumps. The main triplex pump used for initiating and propagating fractures can create hydraulic pressure up to a maximum of 1,350 psi. All plumbing fittings and frac hoses are rated for greater pressure than the triplex pump can generate. The EF9300 has protective shrouding and shields around all moving and rotating components used for mixing and pumping. An operator will be supervised and trained on the unit by an experienced Geo Tactical employee for multiple hours before being deemed competent enough to operate on their own.

Additional PPE required beyond standard oilfield PPE¹

Nitrile gloves

Splash goggles

Some injection reagents may require additional PPE; for handling, consult Manufacturer's requirements

INSTRUCTIONS

1. Review critical operating procedure 011 "Starting the EF9300" and start accordingly.
2. Inspect the triplex pump, and hydraulic fittings for leaks.
3. Inspect all gauges on the control panel and ensure the "Data Acquisition" (DA), "Horn", "Lights", and "Deck & Triplex Lights" switches work.
4. Turn on the DA unit.
5. Visually inspect all fittings prior to connecting the frac hose.
6. Connect the discharge assembly to the discharge fitting on the front side of the unit.
7. Connect the remote pressure transducer to the discharge assembly.
8. Connect the 1" hose via railroad union to the discharge assembly.
9. Attach frac hose to the wellhead assembly at the borehole.
10. Review the horn signaling procedure: one horn blast means that pumping will start; two horn blasts mean pumping has ceased but all equipment is still pressurized; three horn blasts mean pressure has subsided and the lines and EF9300 are safe to approach.

¹ Standard Oilfield PPE comprises the following:

Fire Retardant Coveralls with high visibility striping

Hardhat

Safety Glasses

Work gloves

Steel-toed boots

11. Refer to the critical operating procedures regarding the amendment being used and mix accordingly.
12. Review critical operating procedure(s) based upon the type of drilling used (034 and 035 - Direct Push Fracturing (Disposable Head)" and "Direct Push Fracturing (Fixed Head)").
13. Open the downhole valve.
14. Ensure that the recirculation valves are closed.
15. Move auger lever(s) pertaining to tank(s) containing the slurry to "Feed".
16. Before starting to pump, blast the horn once.
17. Slowly start pushing the triplex pump lever forward while carefully monitoring the pressure on the gauge as well as the flow rate on the DA unit.
18. Continue increasing pump rate to a maximum of 420 L/min. Shut down immediately if reaching 1,350 psi (9,300 kPa)
19. When finished with the fracture, switch to gel or water to flush remaining amendment or proppant out of the pump and lines.
20. After the pumping is completed, blast the horn twice.
21. Monitor the pressure on the gauge and the DA unit.
22. When pressure subsides, open one of the recirculation valves to release any residual pressure.
23. Blast the horn three times after the pressure has subsided.
24. At the end of the day, download the data recorded on the DA unit onto a floppy disk.
25. Ensure that the data has been recorded by downloading it onto a field laptop.

TASK DETAILS

The pre-work inspection and start up should be completed by the EF9300 unit operator. In cold weather conditions, run heaters on plumbing fitting and engine compartment prior to engaging the engine (if and when possible). Boosting of the battery from a vehicle or forklift may be required in cold weather conditions. When fracturing, always use hoses rated for a minimum of 1,500 psi.

SEE NEXT PAGE FOR RISK ASSESSMENT MATRIX



DECEMBER, 2018
V1.R3

CRITICAL PROCEDURE – DIRECT PUSH DRILLING/FRACTURING (DISPOSABLE HEAD)

Direct push drilling is used to collect soil samples, create well borings and advance fracturing tools into the subsurface. Anyone working in the vicinity of the drill rig should know the rigs basic features and emergency shutoff locations. Only a trained certified operator shall operate the drill. When drilling or fracturing there must be an exclusion zone in place, only approved personnel are to be allowed in the exclusion zone.

TOOLS

Pipe wrenches
Wire brush
Hammer

Additional PPE required beyond standard oilfield PPE¹

Nitrile gloves
Splash goggles

Some injection reagents or contaminants may require additional PPE for handling, consult Manufacturer or NIOSH² for PPE recommendations

INSTRUCTIONS

1. Ensure that the site has been cleared for both private and public underground utilities.
2. Prior to drilling, set up an exclusion zone around the immediate work area.
3. Tighten rods by hand, then snug with backed up pipe wrenches.
4. Tighten rods constantly to prevent thread fatigue.
5. Once at depth pull back the rods approximately three inches to disengage the head.
6. Once tool is disengaged, put on the direct push fracturing wellhead and secure whip check to drill rods and frac hose. Remember to connect the wellhead assembly with backed up pipe wrenches.
7. Connect frac hose and SHUT the wellhead pressure relief valve.
8. Lower the mast of the drill rig so that it sits atop the wellhead assembly or slightly above, this is to prevent the rods from sliding up in the event of a high pressure frac or injection.

¹ Standard Oilfield PPE comprises the following:

Fire Retardant Coveralls with high visibility striping
Hardhat
Safety Glasses
Work gloves
Steel-toed boots

² NIOSH – National Institute for Occupational Safety and Health. *NIOSH POCKET GUIDE TO CHEMICAL HAZARDS*

9. Once pumping event has stopped and operator has given the all clear signal (three blasts or verbal notice), have the driller push the wellhead assembly back down to engage the tip (approximately three inches).
10. Relieve pressure from the line using the wellhead pressure relief valve.
11. Disconnect the frac hose from wellhead assembly with the valve OPEN.
12. Use a bail head to pull out rods, secure pipe in an open borehole with a pipe vise or shoe.
13. NEVER hold, pull or push pipe by hand in an open borehole.

TASK DETAILS

Generally two to three people for drilling or fracturing. Set up an exclusion zone where only trained and competent personnel are permitted.

SEE NEXT PAGE FOR RISK ASSESSMENT MATRIX



DECEMBER, 2018
V1.R3

CRITICAL PROCEDURE – DIRECT PUSH DRILLING/FRACTURING (FIXED HEAD)

Direct push drilling is used to collect soil samples, create well borings and advance fracturing tools into the subsurface. Anyone working in the vicinity of the drill rig should know the rigs basic features and emergency shutoff locations. Only a trained certified operator shall operate the drill. When drilling or fracturing there must be an exclusion zone in place, only approved personnel are to be allowed in the exclusion zone.

TOOLS

Pipe wrenches
Wire brush
Hammer

Additional PPE required beyond standard oilfield PPE¹

Nitrile gloves
Splash goggles

Some injection reagents or contaminants may require additional PPE for handling, consult Manufacturer or NIOSH² for PPE recommendations

INSTRUCTIONS

1. Ensure that the site has been cleared for both private and public underground utilities.
2. Prior to drilling, set up an exclusion zone around the immediate work area.
3. Tighten rods by hand, then snug with backed up pipe wrenches.
4. Tighten rods constantly to prevent thread fatigue.
5. Push rods and tool to the first fracture depth.
6. Once at depth flush tool with water (see Critical Procedures – Flushing Down-hole Tool) if necessary.
7. Once tool is cleaned, secure whip check to drill rods and frac hose and connect the wellhead assembly with backed up pipe wrenches.
8. Connect frac hose and SHUT the wellhead pressure relief valve.
9. Lower the mast of the drill rig so that it sits atop the wellhead assembly or slightly above, this is to prevent the rods from sliding up in the event of a high pressure frac or injection.
10. Pump the fracture.

¹ Standard Oilfield PPE comprises the following:

Fire Retardant Coveralls with high visibility striping
Hardhat
Safety Glasses
Work gloves
Steel-toed boots

² NIOSH – National Institute for Occupational Safety and Health. *NIOSH POCKET GUIDE TO CHEMICAL HAZARDS*

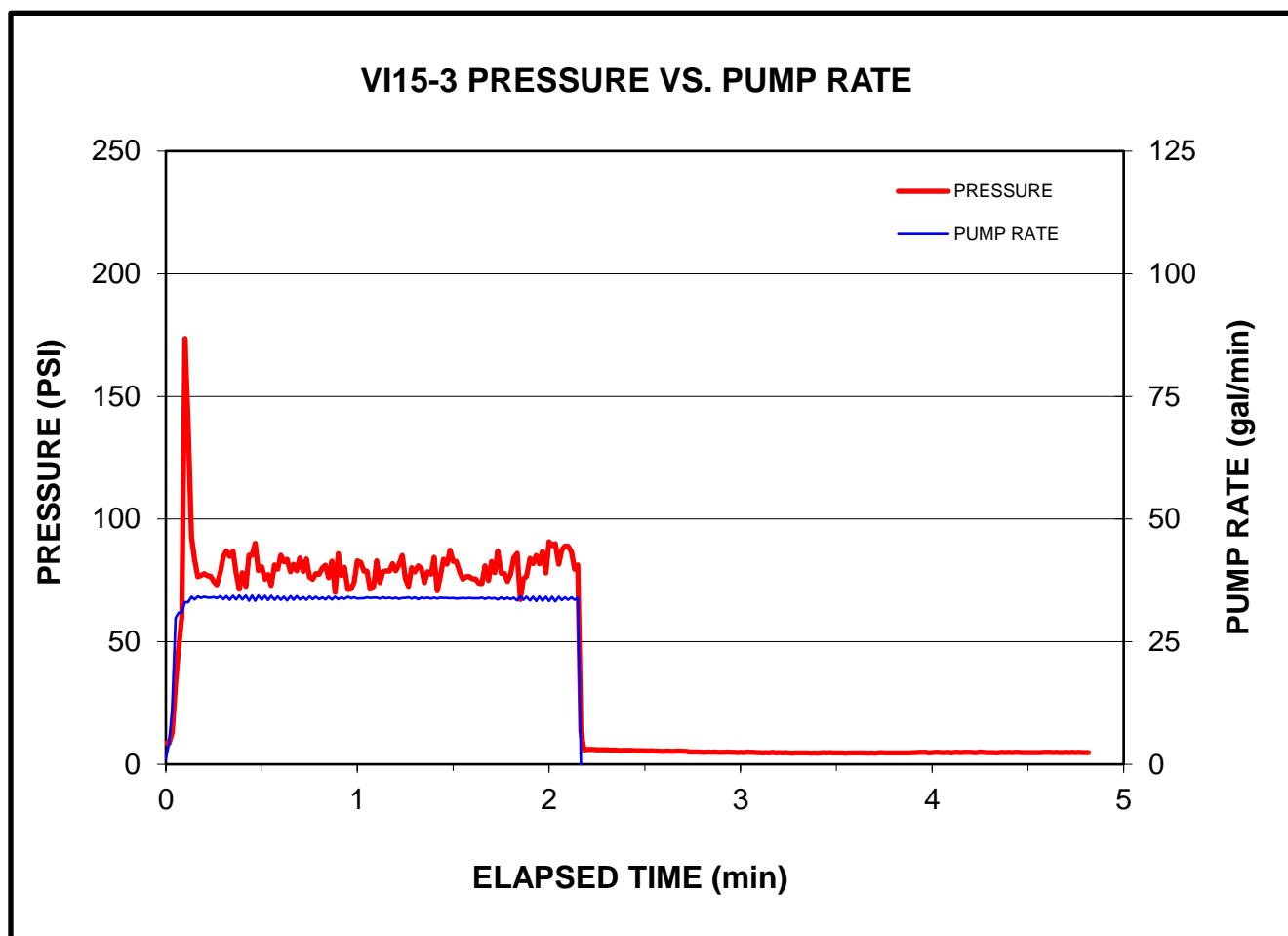
11. Once pumping event has stopped and operator has given the all clear signal (three blasts or verbal notice) relieve pressure from the line using the pressure relief valve.
12. Disconnect the frac hose from wellhead assembly with the valve OPEN.
13. Push rods and tooling to the next depth.
14. Repeat steps 5 to 10 until all fracture depths have been completed.
15. Use a bail head to pull out rods, secure pipe in an open borehole with a pipe vice or shoe.
16. NEVER hold, pull or push pipe by hand in an open borehole.

TASK DETAILS

Generally, two to three people for drilling or fracturing. Set up an exclusion zone where only trained and competent personnel are permitted.

SEE NEXT PAGE FOR RISK ASSESSMENT MATRIX

FRACTURE DATA



PROJECT NUMBER:	J1804	DATE:	13 September 2018
FRACTURE NO.:	VI15-3	FRACTURE BOREHOLE:	VI15
FRACTURE DEPTH:	6.0 (ft.)	SOIL TYPE:	Unknown
SLURRY VOL PUMPED:	42 (gal)	PLACEMENT EFFICIENCY:	100 (%)
AMENDMENT TYPE:	ZVI	AMENDMENT MASS PUMPED:	227 (lbs)
BREAK PRESSURE:	174 (PSI)	AVERAGE PUMP RATE:	34 (gal/min)

Appendix E
Standard Operating Procedures

SOP 1 – SITE ACCESS AND PERMITS

Utility clearance will be requested through Blue Stakes of Utah prior to commencement of any sampling activities that will require excavation or drilling. Depending on the configuration of the project site, Wasatch may have a private utility locate performed in addition to Blue Stake clearance.

All necessary plans and permits (i.e., traffic control plans, right of way encroachment permits, etc.) will be obtained by Wasatch prior to commencement of any sampling activities.

Access agreements will be obtained with the owners, occupants, or lessees of any off-site properties prior to commencement of sampling activities to be conducted on any off-site properties. Access agreements will be in writing.

Start cards will be obtained through the State of Utah Department of Natural Resources, Division of Water Rights, for any monitoring wells that will extend to depths of 30 feet or greater.

SOP 2 – EQUIPMENT AND MATERIALS

Equipment used in the execution of field activities will be inspected, maintained, and calibrated by Wasatch field personnel per manufacturer's instructions. All field equipment will be inspected before and after each use. Equipment requiring calibration will be calibrated, according to the manufacturer's instructions, before each use. Field equipment will be recalibrated as necessary if field readings appear to be abnormal. Equipment calibration will be documented in field notes or on an equipment calibration log. Any reusable field equipment that will come into contact with sampled environmental media will be decontaminated before each use. Equipment that repeatedly malfunctions or is significantly damaged will be removed from service, and a replacement provided, until it has been properly repaired.

The following equipment may be used during investigation activities:

- **Photoionization Detector (PID)** will be used to monitor the atmosphere for volatile organic compounds (VOCs) and to field screen soil cores for VOCs.
- **Lower Explosive Limit (LEL)/Multi Gas Meter** will be used to monitor oxygen and explosive gas levels in the atmosphere and in underground storage tanks (USTs) during UST removals.
- **Personal Protective Equipment (PPE)** will be used in accordance with the site-specific health and safety plan (HASP). Field personnel will be equipped with protective clothing, gloves, hearing protection, eye protection, respiratory protection, safety glasses, safety-toed boots, and hard hats as dictated by site conditions and the HASP. At a minimum level D PPE will be used during all field activities.
- **Decontamination Supplies** will be used to clean and decontaminate sampling equipment and personnel. Decontamination supplies includes items such as, but not limited to, Alconox®, Liquinox®, buckets, brushes, spray bottles, pressure washers, paper towels, potable water, distilled water, and deionized water.
- **Disposable Bailers** will be used for collecting groundwater samples from monitoring wells and piezometers. Disposable bailers may also be used for the removal of light non-aqueous phase liquids (LNAPL) from monitoring wells and piezometers, and during the development process of monitoring wells and piezometers.
- **Multi-parameter Water Quality Meters** will be used to measure temperature, specific conductivity, oxidation-reduction potential (ORP), dissolved oxygen (DO), pH, and turbidity while purging groundwater from monitoring wells prior to collecting groundwater samples. Stabilization of these measured parameters indicates when the purged water is representative of the groundwater within the aquifer and; therefore, when it is appropriate to collect a groundwater sample for laboratory analysis.
- **Water Level Indicators** will be used to measure depth to groundwater in monitoring wells and piezometers.
- **Interface Probes** will be used to measure the depth to light non-aqueous phase liquids (LNAPL), depth to dense non-aqueous phase liquids (DNAPL) and depth to groundwater in monitoring wells and piezometers.
- **Data Loggers and Transducers** will be used to measure changes in groundwater levels during aquifer tests such as slug tests and pump tests.
- **Slugs** made of stainless steel or polyvinyl chloride (PVC) pipe and weighted with sand or cement, will be used to induce fluctuations in groundwater levels for slug tests.
- **Summa Canisters/Tedlar Bags and Flow Regulators** Summa canisters of various sizes equipped with flow regulators will be used for collecting soil gas, sub-slab soil gas, indoor air, and background outdoor air samples for laboratory analysis of VOCs. Additionally, tedlar bags may be used to sample vapor when a pumping apparatus is present in lieu of the Summa canisters.
- **Vapor Pins** will be used to create sampling points for the collection of sub-slab soil gas samples.

- **AQR Color-Tec® Tubes** - AQR Color-Tec® tubes will be used to field screen soil gas and groundwater for VOCs.
- **Measuring Devices** include tape measures, measuring wheels, global positioning systems (GPS), total stations, transits, levels, and rods. These devices will be used to locate and map the locations and dimensions of site features and sampling locations, and to measure top of casing elevations of monitoring wells and piezometers.
- **Monitoring Well Construction materials** will consist of Schedule 40 or 80 PVC or stainless steel casing, machine slotted continuous wire wrapped well screen, and well foot; lockable well caps; traffic rate well vaults; monument well boxes; silica sand; bentonite; grout/heat cement; and concrete.
- **Split-Spoon Samplers and Continuous Core Samplers** will be used to collect soil samples, with minimal disturbance to the soil, during drilling activities. The soil samples may be collected for logging subsurface conditions, field screening, and/or laboratory analysis.
- **Pumps and Ancillary Sampling Equipment** including peristaltic pumps, down-well electric pumps (such as Grundfos pumps), down-well pneumatic pumps (such as bladder pumps), pump controllers, tubing, groundwater filters, stainless steel bowls, stainless steel sample trowels, and hand augers will be used as appropriate for various sampling activities.
- **Drill Rigs** such as direct-push, cone penetrometer, hollow-stem auger, ODEX, air rotary, and sonic rigs will be used as appropriate for advancing exploratory borings, collecting soil and groundwater samples, and installing monitoring wells and piezometers. Drill rigs will be supplied and operated by subcontractors with direction and oversight from Wasatch Environmental, Inc. Drilling subcontractors will be required to provide their own PPE and decontamination equipment, and required to comply with the HASP created by Wasatch.
- **Cutting and Coring Equipment** will be used to cut or core through concrete and asphalt to allow access for drilling and sampling.
- **Hand/Power Tools** including, but not limited to, hammers, drills, saws, screw drivers, wrenches, etc., will be used with caution and only for the intended purposes of each piece of equipment.
- **Soil Gas Sampling Probe** The probe consists of a slide hammer, metal rods, and drive points. Prior to each use all connections will be inspected and verified tight, and all equipment that comes in contact with environmental media will be decontaminated prior to use.

SOP 3 – CONCRETE AND ASPHALT CUTTING AND CORING

Subsurface exploration points in areas covered by concrete or asphalt that will require coring or saw-cutting prior to drilling or pushing the exploration point to minimize damage to the concrete or asphalt will be decided by Wasatch personnel prior to the commencement of sampling activities. Concrete and asphalt cores and cuts will be made as small as necessary. A coring and sawing subcontractor or Wasatch personnel will be used to perform the work. The sub-contractor, or Wasatch personnel, will follow standard procedures for concrete and asphalt coring and sawing. Coring or saw-cutting may be performed prior to drilling or pushing the exploration point.

SOP 4– DIRECT-PUSH SOIL AND GROUNDWATER SAMPLING PROCEDURES

A track or truck mounted direct-push probe will be used to advance shallow depth soil borings. This equipment will be used at sites where access restrictions, such as roof overhangs, prevent mobilization of a truck-mounted hollow-stem auger rig or Wasatch personnel deem it is necessary.

Soil borings will be advanced and sampled using a hydraulic hammer. The boreholes will be advanced by pushing a steel drill stem equipped with a polybutyrate lined core barrel. No lubricants, circulating fluid, or other additives will be used to advance the direct-push probe.

Soil samples will be continuously collected, starting at the ground surface, by hydraulically pushing a decontaminated polybutyrate lined core barrel sampler. The sampler will be attached to the drill rod, lowered to the sample interval, and then pushed or driven.

Upon retrieval from the borehole, the sampler will be opened, soil will be screened using appropriate instruments as required, and field-classified for geologic logging. Samples will be extracted from the sampler using a decontaminated stainless steel spoon, gloved hands, or method 5035A sampling device as required. The specific sampling method(s) will be specified in the applicable work plan. Soil samples collected for laboratory analyses will be placed in appropriate laboratory supplied containers and preserved as required.

Soil samples for laboratory analysis will be collected by the field geologist or environmental scientist based on criteria such as field screening results, odors, visual indications of contamination such as staining, or geologic formation. The number, type, depth, and interval of samples to be obtained will be specified in the Sampling and Analysis Plan or work plan for specific phases of field work.

Groundwater samples will be collected using either an expendable, down-hole, stainless steel, sampling screen attached to low-density polyethylene (LDPE) tubing, or polytetrafluoroethylene (PTFE) lined LDPE tubing if required, connected to a peristaltic pump. Alternatively, a temporary piezometer constructed of schedule-40 polyvinyl chloride (PVC) riser pipe and machine-slotted well screen will be installed, into which LDPE tubing (or PTFE-lined LDPE tubing) will be inserted and connected to a peristaltic pump. Groundwater samples collected for laboratory analyses will be placed in appropriate laboratory supplied containers and preserved as required.

Samples will be packed, sealed, and shipped/transported in accordance with the **Sample Documentation and Handling SOP**. Excess material will be handled in accordance with the **Investigation-Derived Waste Management SOP**. Samplers, bowls, trowels, and spoons will be decontaminated in accordance with the **Decontamination SOP** when required.

SOP 5 – HOLLOW-STEM AUGER DRILLING

Hollow-stem auger (HSA) borings will be sampled continuously or will be sampled at intervals sufficient to describe lithology and to provide samples for laboratory analysis. The borings will be drilled with a truck or track-mounted HSA drilling rig. The augers will typically consist of 5-foot-long sections. A center plug will be placed at the bottom of the auger and held in place by drill pipe that is added along with each auger section. The center plug will prevent soil and liquefied sands from entering the bottom of the auger string as the boring is advanced. If loose or saturated sands are encountered, clear water may be added to the auger stem to equalize upward pressure and prevent the upward flow of sand through the center of the auger during sampling.

Sampling will typically be performed using a 2.5 to 5-foot-long continuous core barrel. The continuous core barrel is attached approximately 3 to 6 inches in front of the auger tip and is advanced as the augers are drilled into the ground. Because the core barrel is located ahead of the augers, a relatively undisturbed sample can be obtained. The continuous core may not be useable in formations containing cobbles and boulders.

As an alternative, soil samples may be collected in the following sequence: the augers will be drilled to the proposed sample depth. The center plug will be removed, and a decontaminated split-spoon sampler will be lowered through the center of the auger on a small diameter drilling rod, and driven into the undisturbed soils below the bottom of the auger. The sampler will be driven by repeatedly dropping a hydraulic hammer (typically 140-pound hammer) weight approximately 30 inches on the drill rod. Total blows will be counted for each 6-inch increment.

After the soil core is retrieved from the borehole, it will be opened and the soil will be field screened with the appropriate instrumentation as required. The soil will be field classified for the geologic log, and laboratory analytical samples (if any) will be collected.

Soil samples collected for laboratory analysis will be extracted from either the split-spoon samplers or continuous core barrel samplers. In all cases, the soil will be removed from the sampler using a decontaminated stainless steel spoon or gloved hands.

Samples will be packed, sealed, and shipped/transported in accordance with the **Sample Documentation and Handling SOP**. Excess material will be handled in accordance with the **Management of Investigation-Derived Waste SOP**. Samplers, bowls, and spoons will be decontaminated in accordance with the **Decontamination SOP** when required.

SOP 6 – SONIC DRILLING

Sonic borings provide continuous soil cores facilitating accurate lithology descriptions and discrete sample collection for laboratory analysis. The borings will be drilled with a truck or track-mounted sonic drilling rig. The drill rods will typically consist of 5 to 10-foot-long sections. The drill rods, core barrel, and casing (when sloughing occurs) are advanced using high frequency resonance and rotary action. Initially, the core barrel will be advanced followed by the casing to stabilize the borehole. Once the casing is in-place, the core barrel is removed from the boreholes and the soil core is extruded in plastic bags using compressed air or vibration. This process is followed until the desired depth is achieved. If flowing sands are encountered, clear water may be added to the casing to equalize upward pressure and prevent the upward flow of sand through the center of the casing during sampling.

Soil cores are typically sealed in plastic bags as they are retrieved from the bore hole by the drillers. The plastic bags will be opened and the soil will be field screened with the appropriate instrumentation as required. The soil will be field classified for the geologic log, and laboratory analytical samples (if any) will be collected.

Soil samples collected for laboratory analysis will be extracted from the plastic bags. The soil will be removed from the bags using a decontaminated stainless steel spoon or gloved hands.

Samples will be packed, sealed, and shipped/transported in accordance with the **Sample Documentation and Handling SOP**. Excess material will be handled in accordance with the **Management of Investigation-Derived Waste SOP**. Samplers, bowls, trowels, and spoons will be decontaminated in accordance with the **Decontamination SOP** when required.

SOP 7 – CONE PENETRATION TESTING

The Cone Penetration Test (CPT) is a geotechnical site characterization tool which provides a continuous profile of the soil stratigraphy and properties. The CPT consists of an instrument probe which is pushed into the ground using a hydraulic load frame. The hydraulic load frame is typically mounted on a heavy truck or tracked carrier. The probe includes a tip and friction sleeve that provides independent measurements of vertical resistance beneath the tip and frictional resistance along the side of the probe as a function of depth. The penetrometer is normally advanced vertically into the soil at a constant rate of 2 centimeters per second and data are recorded at 5-centimeter intervals. These data are transmitted to an on-board computer and printed out in numerical and graphical format. Pore pressure data is also obtained to evaluate the presence of groundwater.

The CPT rig can be modified to obtain discrete-depth groundwater samples. The discrete groundwater samples will be obtained using a hydropunch. The hydropunch is driven into the ground using the hydraulic load frame. The CPT pore-pressure readings from the previous CPT are used to determine the depth the hydropunch sampler is pushed and a sample obtained. After the hydropunch sampler is pushed to the required depth, the sampler is pulled back, exposing an 18-inch long (typically) stainless steel screen. The sampler is allowed to fill with the water, after which a stainless-steel bailer will be lowered, and a sample obtained. The bailer will be lowered using a clean disposable line. The hydropunch sampler and bailer will be decontaminated according with the **Decontamination SOP**.

After completing the CPT or hydropunch sample, the resulting hole will be abandoned in accordance with the **Borehole Abandonment SOP**. All down-hole CPT equipment will be decontaminated prior to the first CPT, between CPTs, and at completion of the project. Decontamination procedures are described in the **Decontamination SOP**.

SOP 8 – BOREHOLE ABANDONMENT

Soil borings will be abandoned according to the State of Utah Administrative Rules for Water Well Drillers (Utah Division of Water Rights, 1995). Boreholes from the ground surface to 30 feet below natural land surface will be abandoned with granular bentonite, 3/8-inch bentonite chips, or bentonite slurry. Additionally, the granular/chip bentonite will be hydrated with clean water.

Boreholes greater than 30 feet below ground surface will be abandoned, using Portland Type A cement grout, mixed in a ratio of approximately 94 pounds (one bag) of cement to 5 to 6 gallons of water with approximately 3 percent (by weight) bentonite, bentonite slurry, or with 3/8-inch bentonite chips hydrated at 5-foot intervals. The grout or slurry will be added to the borehole using a tremie pipe and grouted from the bottom of the borehole to the ground surface to ensure all of the voids are filled. If a depression is observed after abandonment is completed, grout, slurry, or bentonite chips will be added to the borehole up to the ground surface ensuring that all of the voids are filled. The location of the soil boring will be marked with a survey stake so the boring can be readily located, during the survey activities, if the boring has not been previously surveyed. All borehole abandonment information, including the description of the amount and type of grout as well as the date of abandonment, will be documented in the logbook and/or on a Boring Log Form.

SOP 9 – BOREHOLE REFUSAL CRITERIA

Buried utilities, debris, boulders, slag, or other subsurface conditions may halt the advancement of exploration points. In these cases, the borehole will be abandoned according to methods described in the **Borehole Abandonment SOP**, and a new boring will be placed not more than 5 feet away from the abandoned borehole. The new boring will be advanced to the depth of the abandoned borehole and sampling will resume. Prior to drilling the new exploration point, the site must be verified to be clear or re-cleared in accordance with the **Site Access and Permits SOP**.

SOP 10 – FIELD CLASSIFICATION OF SOILS

A geologist/ hydrogeologist or other qualified individual will log the soil core and soil samples obtained in the soil borings. Soils will be classified based on grain size, degree of sorting, color, moisture content, consistency, odor, staining, consistency, and soil type based on the Unified Soil Classification System. The soil description typically will also include the soil particle angularity. Lithology data will be recorded on a Boring Log Form or in a field notebook.

SOP 11 – EQUIPMENT CALIBRATION

All field equipment calibrations will be conducted according to manufacturer's instructions and noted in the field logbook. The water quality meter, PID, and multi-gas meter will be calibrated with known standards prior to use, and as recommended by the manufacturer's instructions throughout the sampling activities. The equipment will be calibrated multiple times a day if deemed necessary based on suspect readings. Calibration standard lot numbers and expiration dates (when applicable) will be recorded in the field logbook or documented on equipment calibration form.

SOP 12 – MONITORING WELL INSTALLATION

Groundwater monitoring wells are typically installed to monitor contaminant concentrations and groundwater levels over time. Prior to the construction of the monitoring well(s), the borings will be drilled following the SOP for the specified drilling method. The drilling method; well construction materials and emplacement depths; well casing length, diameter, and material; well screen length, diameter, slot size, and material; will be specified in the Sampling and Analysis Plan or work plan for the specific phase of investigation.

Monitoring wells will generally be constructed to a depth sufficient to expose at least half of the slotted well screen into the aquifer. Wells designed to monitor shallow water table interface will be constructed following typical construction details so that the screened portion of the well bounds the water table interface. In this manner, the well will observe floating light non-aqueous phase liquid (LNAPL) contamination (if present), dissolved phase contaminants, and fluctuations in the groundwater table. Intermediate and deep monitoring wells may also be installed to monitor the aquifer zones just below the water table interface and in deeper zones. Intermediate and deep wells may have completely submerged well screens. Intermediate and deep monitoring wells are used to monitor dense non-aqueous phase liquids (DNAPL), dissolved phase contaminants, and fluctuations in the piezometric surface elevations.

Monitoring well construction should be initiated within 24 hours of the completion of the borehole. To ensure the stability of the borehole during well construction, the monitoring well will be constructed inside of the auger string, drill casing, or open borehole. After the screen section has been positioned to the designed depth in the borehole, the sand pack consisting of clean, uniformly-sized, silica sand will be placed in the annulus of the borehole and/or auger while the drill string is slowly removed. The depth of the sand pack inside the annular space between the well casing and the borehole will be continuously monitored using a weighted probe. When installing the monitoring well inside an auger string or drill casing, the auger string or drill casing is periodically pulled upward, and the sand settles out through the bottom of the auger string or drill casing; additional sand will be added so the sand always remains in the bottom end of the auger string or drill casing. The sand pack will be added until it is a minimum of 2 feet above the top of the well screen.

After the sand pack is in place, a bentonite seal, no less than 2 feet thick and not to exceed approximately 10 feet in thickness, will be placed on top of the sand pack. Bentonite pellets will be added at the top of the sand pack with a tremie pipe or equivalent method to prevent bridging as the drill string is slowly withdrawn. The thickness of the bentonite seal will be monitored with a weighted probe and will be hydrated in approximately 2-foot lifts as needed. Once the desired thickness of bentonite seal is reached, the bentonite will be allowed to settle for approximately 20 minutes. The thickness of the seal will then be verified using the weighted probe. After the bentonite seal is in place, the remaining open annular space will be grouted to the ground surface through the drill string or open borehole.

The well screen and casing will be new and composed of materials that will not alter the water samples for constituents of concern and that are appropriate for the monitoring of environmental samples (typically Schedule-40 PVC or stainless steel). To prevent introduction of contamination into the borehole, flush-threaded screens and casing will be used. No glues or adhesives will be used to construct the monitoring wells.

After the monitoring wells have been grouted in place, the well will be fitted with a flush-mounted or riser-mounted protective steel vault set in a concrete pad. The type of completion will depend on the well location and potential interference. Typically, monitoring wells completed in open fields will be riser-mounted, and monitoring wells in high-traffic areas will be completed as flush-mounts. Monitoring well construction information will be recorded on a Boring Log Form or in a field notebook. The following information will be compiled and documented on the Boring Log Form or in a field

notebook, if applicable:

- Date/time of boring and/or installation
- Method of drilling
- Approximate location
- Depth to groundwater
- Drilling Contractor
- Borehole diameter and casing diameter
- Stratigraphy
- Casing materials
- Screen materials and slot size
- Filter pack material and amount
- Seal materials and amount
- Height of stickup or drop from ground surface
- Detailed drawing of completed monitoring well

SOP 13 – MONITORING WELL DEVELOPMENT

Development of newly installed monitoring wells will be performed as soon as practical after well installation, but no sooner than approximately 24 hours after well installation and annular seal placement is complete. The purpose of development is to restore the natural hydraulic conductivity of the formation and remove foreign sediment and fine-grained sediments, introduced during drilling activities.

Development of each well will be accomplished by bailing and surging, pumping, or a combination of these methods. The depth to groundwater and the total depth of the casing will be measured and recorded on the field notebook prior to, and immediately after, development. Development will be performed using the following method: a bailer will be lowered down the borehole until it contacts the surface of the water. Once the bailer is filled, it will be withdrawn from the water to create an upward surge. Short strokes near the bottom of the well will help to produce a sediment slurry that can be removed. After a majority of the sediment is removed, a submersible or airlift pump will then be lowered into the well and set at a discharge rate that is equal to the recovery rate if possible. The pump will be raised and lowered through the screened section of the well to remove finer sediment. This method will be continued until the conditions described below are met. The method will be repeated until a majority of the sediment is removed.

Temperature, turbidity, pH, and specific conductivity will be measured using portable monitoring equipment during well development upon request, but will not typically be monitored. If requested, the measurements will be taken at the beginning, intermittently during well development, and at the completion of well development.

Development will continue until the following conditions are met:

- Sediment which rapidly settles out of solution is no longer present in water samples.
- At least five wet casing well volumes have been removed.
- If requested, three consecutive water quality measurements meet the following criteria:
 - pH ± 0.1 difference in consecutive readings,
 - Temperature ± 3 percent difference in consecutive readings,
 - Specific conductivity ± 3 percent difference in consecutive readings, and
 - Turbidity ≤ 5 nephelometric turbidity units (NTUs) or < 10 percent difference in consecutive readings.

If well recharge is insufficient that the required volume cannot be met within 24 hours, or the well bails dry three times after allowing the well to recharge to 90 percent of the static water column, or water quality criteria cannot be met, the Project Manager will determine if well development should continue.

Meters used for water quality measurements will be calibrated on each day of use according to the manufacturer's specifications. The meters will be recalibrated any time meter drift is suspected. Instrument calibration will be documented in the field logbook and/or on the Equipment Calibration Form.

Pertinent information collected during well development will be recorded in a field notebook.

Pertinent information required includes well identification, date and time of development, field personnel, method of development, meters used to measure water quality parameters, calibration procedures, measured water quality parameters, discharge rates, amount of water evacuated from the well (in gallons), beginning and ending water level, and beginning and ending total well depth measurements.

No water, dispersing agents, acids, disinfectants, or other additives will be introduced to the well after the annular seal is installed or during well development. Development water will be placed into mobile storage tanks or 55-gallon drums (when necessary) and disposed of according to the **Management of Investigation-Derived Waste SOP**.

SOP 14 – GROUNDWATER SAMPLING

The specific sampling method(s) will be specified in the sampling and analysis plan or work plan, and are discussed below.

Low-Flow Purging and Sampling

Groundwater monitoring conducted using low-flow sampling techniques requires a peristaltic pump and a multi-parameter water quality meter to allow for the collection of additional geochemical data including temperature, specific conductivity, pH, oxidation-reduction potential (ORP), dissolved oxygen (DO), and turbidity.

Groundwater samples collected using a low-flow sampling procedure would follow the appropriate United State Environmental Protection Agency (U.S. EPA) guidelines. The sampling procedure would involve inserting ¼-inch I.D., low-density polyethylene tubing into each monitoring well. The tubing would be run through a peristaltic pump, then to a flow cell to which a multi-parameter water quality meter was attached, and finally to a 5-gallon bucket to collect purge water. Initial water levels would be measured and recorded prior to the initiation of pumping. Once pumping is initiated, water levels, pumping rate, cumulative volume purged, water temperature, specific conductivity, pH, ORP, DO, and turbidity would be recorded at 3 to 5-minute intervals until either stabilization was achieved or the well pumped dry. Pumping rates would be maintained at a rate of less than 250 milliliters per minute to minimize drawdown. Stabilization is defined as three consecutive measurement intervals where temperature and specific conductivity are +/- 3%, pH is ±0.1, DO is ±10% (or less than 0.5 mg/L), and turbidity is ±10% (or less than five nephelometric turbidity units [NTUs]). If the monitoring well pumps dry, it would be allowed to recharge to a minimum of at least 90% of their static water level prior to sampling (this applies to all groundwater sampling methods where the well pump is dry). After stabilization is achieved, the tubing would be disconnected from the flow through cell and the groundwater samples would be dispensed into laboratory-supplied sample containers. The sample containers would each be labeled with the analysis required, samplers name, sample I.D., sample location, date and time of sample collection. The samples would be place in a cooler with ice and transported under chain-of-custody protocol to a Utah certified laboratory for analysis. All pertinent sampling parameters or observations would also be recorded in the field log book or on the groundwater sampling form.

Standard Purging and Sampling

Prior to each sampling round, the monitoring wells will be purged to remove stagnant water from the well casing, thereby allowing the collection of an analytical sample that is representative of formation water. The well casing purge volume will be calculated as follows:

$$\text{Purge volume (in gallons)} = \pi r^2 \times h \times c$$

where: r = radius of well (ft)

h = height of water column (ft)

c = conversion constant (7.48 gal/ft³)

Wells will be purged using a stainless steel bailer, Teflon® bailer, polyethylene bailer, polyvinyl chloride (PVC) bailer, stainless steel submersible pump, gas bladder pump, PVC submersible pump, or

peristaltic pump. Polyethylene bailers, PVC bailers, and nylon twine are disposal items, used only once and will not be decontaminated or re-used at multiple wells. Groundwater samples collected for laboratory analysis may also be collected using a low flow peristaltic or submersible pump equipped with dedicated or disposable tubing.

The collection of groundwater samples will proceed after a minimum of three well casing volumes of water have been purged. If using a bailer, the bailer will be gently lowered into the water to minimize aeration during sampling. For VOC samples obtained with a peristaltic or submersible pump, the pump discharge rate will be set so that the discharge does not exceed approximately 100 milliliters per minute when sample containers are being filled. The pump will be operated up in accordance with manufacturer's instructions. Groundwater samples to be analyzed for VOCs will be collected before other analytical samples, and the vials will be completely filled with no visible bubbles present to minimize the potential for aeration of the sample. Groundwater samples collected for other various laboratory analysis will be placed directly into the laboratory supplied sample containers. When filling the sample bottles that contain preservative, care will be taken not to overfill the containers and deplete the preservatives.

Duplicate and matrix spike/matrix spike duplicate groundwater sample bottles (if collected) should be filled at the same time the regular sample bottles are filled. Alternate the filling of bottles by first filling a normal sample bottle and then a duplicate sample bottle. This method of filling alternating bottles should continue until both sets of bottles are filled.

Passive Diffusion Bag Sampling

Passive diffusion bags (PDBs) come in a variety of diameters and lengths typically ranging from ½ inch to 1.5 inches in diameter and 1 foot to 4 feet in length. PDBs are typically used to sample for VOCs. When possible pre-filled PDBs will be used. When PDBs that are not prefilled the PDB will only be filled with deionized water and secured per manufacture specifications.

When sampling groundwater using PDBs all down-well equipment and/or supplies must be new, disposable, or dedicated to the well. All weights, clips, fasteners, and/or metal cables used to place the PDB will either be new, or decontaminated prior to placement. Other disposable types of ropes may be used to place the PDB, but must be discarded upon completion of sampling.

The disposable rope or metal cable will be carefully pre-measured and cut to place the PDB at the desired depth interval within the monitoring well screen interval. An appropriate weight (preferable a stainless-steel weight) will be securely attached to the bottom of the PDB, and then the PDB will be fastened to the rope or cable. Once attached to the rope/cable the PDB will be lowered into the monitoring well and the top of the rope/cable will be securely fastened to the top of the well or the well cap. The passive diffusion bags will remain within the well for a minimum of two weeks, or the length of time specified by the manufacturer. Once the minimum time requirement has been achieved the PDB will be carefully removed from the monitoring well to avoid tearing the PDB. The PDB will be secured and sampled within five minutes to prevent the loss of VOCs. Sampling begins by inserting the manufacturer-supplied sampling straw into the PDB. The sampling straw should be clipped shut or bent to prevent discharge when inserting the straw into the bag and to regulate the sample flow from the PDB. The sample flow will then be regulated to facilitate the sample collection of VOCs discussed in the Standard Purging and Sampling Section.

Multiple PDBs may be attached to a single rope/cable and placed into a monitoring well to capture data from specific depth intervals within the screened interval. Follow the above instructions for multiple PDB deployment.

HydraSleeve Sampling

The appropriate HydraSleeve (HS) size and placement within the monitoring well will be determined by the Wasatch project manager, and will be based on the inside diameter of the well, the length of the well screen, the water level in the well, the position of the well screen in the well, the total depth of the well.

When sampling groundwater using HSs all down-well equipment and/or supplies must be new, disposable, or dedicated to the well. All weights, clips, fasteners, and/or metal cables used to place the HS will either be new, or decontaminated prior to placement. Other disposable types of ropes may be used to place the HS, but must be discarded upon completion of sampling.

Sampling groundwater with the HS is designed to collect a sample directly from the well screen by coring the water column. In short-screen wells, or wells with a short water column, it may be necessary to use a top weight on the HS to compress it in the bottom of the well so that, when it is recovered, it has room to fill before it reaches the top of the screen.

To assemble the HS complete the following:

1. Remove the HS from its packaging, unfold it, and hold it by its top.
2. Crimp the top of the HS by folding the hard polyethylene reinforcing strips at the holes.
3. Attach the spring clip to the holes to ensure that the top will remain open until the sampler is retrieved.
4. Attach the tether/rope/cable to the spring clip by tying a knot in the tether.
5. Fold the flaps with the two holes at the bottom of the HS together to align the holes and slide the weight clip through the holes.
6. Attach a weight to the bottom of the weight clip to ensure that the HS will descend to the bottom of the well.

Always wear sterile gloves when handling and discharging the HS. Before deploying the HS in the well, collect the depth-to-water measurement. If necessary, also measure the depth to the bottom of the well to verify actual well depth to confirm your decision on placement of the HS in the water column. Measure the correct amount of tether/rope/cable needed to suspend the HS in the well so that the weight will rest on the bottom of the well (or at your preferred position in the well). Make sure to account for the need to leave a few feet of tether/rope/cable at the top of the well to allow recovery of the sleeve.

To deploy the HS complete the following:

1. Using the tether/rope/cable, carefully lower the HS to the bottom of the well, or to your preferred depth in the water column.
2. Secure the tether/rope/cable at the top of the well by placing the well cap on the top of the well casing and over the tether/rope/cable or secure it to the well cap itself.
3. Prior to sampling the well must be allowed to equilibrate back to static hydraulic conditions. In most cases the HS can be retrieved soon after deployment, but if desired the HS may be left in the well for any desired length of time.

To recover and sample the HS complete the following:

1. Hold on to the tether/rope/cable while removing the well cap.
2. Secure the tether at the top of the well while maintaining tension on the tether/rope/cable (but without pulling the tether/rope/cable upwards).
3. Measure the water level in the well.
4. In one smooth motion, pull the tether/rope/cable up between 30 to 45 inches (36 to 54 inches for the longer HS) at a rate of about ' per second (or faster).
5. Continue pulling the tether/rope/cable upward until the HS is at the top of the well.
6. Decant and discard the small volume of water trapped in the HS above the check valve by turning the sleeve over.
7. Remove the discharge tube from its sleeve.
8. Hold or secure the HS at the check valve.
9. Puncture the HS below the check valve with the pointed end of the discharge tube.
10. Discharge water from the HS into your sample containers. Sample collection should be done immediately after the HS has been brought to the surface to preserve sample integrity.
11. Control the discharge from the HS by either raising the bottom of the sleeve, by squeezing it like a tube of toothpaste, or by pinching/folding the discharge tube.

Measurement of field indicator parameters is generally done during well purging and sampling to confirm when parameters are stable and sampling can begin. Because the HS is a no-purge sampling technique it does not require field indicator parameter measurements to confirm when purging is complete. If field indicator parameter measurement is required to meet a specific non-purging regulatory requirement, it can be done by taking measurements from water within a HS that is not used for collecting a sample to submit for laboratory analysis (i.e., a second HS installed in conjunction with the primary sample collection HS).

Multiple HSs may be attached to a single tether/rope/cable and placed into a monitoring well to capture data from specific depth intervals within the screened interval. Follow the above instructions for multiple HS deployment.

SOP 15 – WATER LEVEL MEASUREMENTS

Groundwater level measurements are taken to evaluate the direction(s) of local groundwater flow to provide a better understanding of site groundwater movement. The information will be used to develop or supplement existing groundwater elevation data and contour maps. The depth to the water table will be measured with an electronic water level indicator. If necessary, an interface probe will be used in wells containing light non-aqueous phase liquid (LNAPL). The instruments used will be decontaminated in accordance with the **Decontamination SOP**. Measurements will be made to the nearest 0.01 foot from the reference point established for the monitoring well. Depth to water measurements will then be converted to elevations to establish true groundwater elevations. Depth to groundwater and total well depth measurements will also be recorded to calculate well casing volumes during monitoring well sampling events.

Surface water level measurements will be taken to evaluate the fluctuations in surface water flows. The depth to the surface water will be measured with an electronic water level indicator. The instrument used will be decontaminated in accordance with the **Decontamination SOP**. Measurements will be made to the nearest 0.01 foot from the reference point established at the surface water monitoring point. Depth to water measurements will then be converted to elevations to establish true surface water elevations.

SOP 16 – AQUIFER TESTING

Information regarding the hydraulic properties of an aquifer will be obtained by measuring water level responses in the monitoring wells by pumping or slug testing. The locations for performing aquifer tests will be determined largely by the final number, distribution, and depth of monitoring wells present. Specific pumping test methods to be employed will be described in individual work plans.

Slug Testing

Slug tests will be conducted by inducing instantaneous changes in the groundwater level and measuring the associated water level response. Changes in water level will be measured with an electronic data recording system that uses pressure transducers (placed below the water level in the well) connected by cable to the data logger or will be manually recorded using an electronic water level meter. Each slug test will consist of at least one slug out (recovery) and slug in (falling head) test (for deep wells) in the monitoring well. Data obtained from these tests will be used to obtain local estimates of hydraulic conductivity of the aquifer near the monitoring well.

In shallow wells (straddling the water table), only slug out (recovery) tests will be performed. In this manner, recovery water levels will reflect the properties of the saturated portion of the aquifer. Falling head tests (slug in) would not be appropriate because they would reflect the properties of the unsaturated sand pack.

Pumping Tests

Two separate pumping tests may be conducted at each well selected for evaluation. The first test would be a short-term, variable-rate discharge test (referred to as a step test) that provide data to calculate the efficiency and specific capacity of each well. The step test will be used to select an appropriate pumping rate for the second test: a long-term, constant-rate discharge test (referred to as a constant-rate pumping test).

It is recommended that background water level and barometric data be collected prior to conducting any pumping tests. These data should be collected for at least 7 days prior to the pumping test to evaluate the barometric efficiency of the well and the long-term water level trend for the well(s).

A step test will be conducted for approximately 2 to 12 hours. During the step test, the well will be pumped at sequentially higher rates until it can no longer sustain the pumping rate. Drawdown will be measured in the pumping well.

The constant-rate pumping test will not be conducted until the static water level in each well returns to approximately the pre-step-test level. The tests will be conducted by pumping the wells at a constant rate over a 24 to 72 hour period, as specified in the task-specific work plan, or until conditions reach a steady state. The pumping rate will be based on analysis of the step test or empirical data. After the test, the pump will be shut off and water recovery will be monitored in the pumping well and observation piezometers until the static water level has returned to at least 90 percent of the pretest level (or up to a maximum recovery period of 24 hours).

During the step tests and constant-rate pumping tests, groundwater levels will be measured in the pumping wells and observation wells with a pressure transducer or an electric water level indicator.

For both the step and constant rate tests, groundwater will be extracted from each pumping well using an electric submersible pump installed to a depth slightly above the bottom of the well. The flow rate and water volumes withdrawn will be monitored using a calibrated flow meter and a flow totalizer. The flow rate will be checked periodically with a calibrated bucket to monitor the accuracy of the flow measurements.

The sequence of procedures to be used to conduct each step test and constant-rate pumping test is as follows:

Place a pressure/barometer transducer in the pumping well and any observation wells at least 7 days prior to testing.

The electric submersible pump will be lowered into the pumping well to a depth approximately 2 feet above the bottom of the well.

The static water level and the total depth of the pumping well, as well as any observation well, will be measured and recorded in the field log book.

A pressure transducer (if used) will be lowered into the well approximately 2 feet above the top of the pump, but not to exceed the transducers depth rating.

Pressure transducers (if used) will be lowered into the adjacent observation wells and positioned slightly above the bottom of the well.

The data loggers will be started simultaneously with pumping to record drawdown data.

As water level drawdown occurs in the pumping well and observation wells, the data logger will record the pressure head, convert the pressure head to water level, and store the data in a separate file for the pumping well or observation well. If a transducer is not used all drawdown data will be collected using an electronic water level meter for the pumping and observation wells.

After the pumping period of the test well recovery data will be recorded.

After the water in the pumping well has recovered to at least 90 percent of the pretest level (or up to a maximum recovery period of 4 hours for the step tests and up to 24 hours for the constant rate test), the test will be terminated and the pressure transducers (if used) will be removed from the well and observation wells.

Groundwater elevations in the pumping well and the observation wells will be recorded using a Insitu (or similar) data logger equipped with pressure transducers. The data logger will be programmed to collect water level measurements logarithmically (frequent intervals at the beginning of the test and longer intervals near the end of the test). The time of first drawdown observed in the observation wells (when the cone of depression reaches a well) will be calculated using appropriated aquifer evaluation equations, with estimates of transmissivity and storativity, along with the radial distance of the well from the pumping well. The data from each well will be evaluated using computer software that interprets aquifer test data by utilizing a variety of methods for analysis. The results may also be cross-checked using graphical techniques for aquifer test analysis if determined to be necessary.

SOP 17 – SUB-SLAB SOIL GAS SAMPLING

Sub-slab soil gas sampling is typically used to evaluate the potential for vapor intrusion into a structure or for locating soil and groundwater impacts.

The location and number of sub-slab soil gas samples to be collected will be determined by Wasatch personnel to provide sufficient coverage, and will be based on the work plan objectives, structure configuration, and size.

Techniques for collecting the sub-slab soil gas samples would begin by checking for a vacuum in each 6-liter Summa, 1-liter Summa, or 400-milliliter canister supplied by the analytical laboratory. Initial vacuums would be recorded on the chain-of-custody form. A 1/2-inch hole would be drilled through the concrete slab at each sampling location using a percussion hammer drill to a depth of approximately 1½ to 3 feet below the concrete slab. A brass vapor pin equipped with a silicone sleeve would be inserted into the hole and a polyvinyl chloride (PVC) coupling will be placed around the vapor pin. Then the annular space between the vapor pin and the PVC coupling will be sealed with hydrated bentonite paste. Next, Teflon-lined tubing would be attached to the vapor pin and then capped. The bentonite paste and sub-slab penetration would be allowed to set for a minimum of ½ hour while the hole equilibrated.

Summa Canisters

A sample regulator with a flow restrictor would be provided by the analytical laboratory. A sample regulator would be attached to each Summa canister. An Entech helium shroud and sub-slab soil gas sampling system will be used to collect the soil gas samples. One tubing volume from each vapor pin location would then be purged using a pump, and then attached to the Entech soil gas collection system gas flow selector. The sample train will be connected to the sample pin and the Summa canister. The sample train flow selector will keep the sample pin isolated while the line to the Summa canister is opened. The vacuum will then be monitored. If a decrease in vacuum is not observed within 5 minutes, the sample train will be considered to be leak free. The helium shroud will then be flooded with helium until a concentration of 20 percent helium is achieved. Once 20 percent helium is achieved, the soil gas sample would be collected in the Summa canister. During the sampling, the sample line will be screened with a helium analyzer for the presence of helium to determine if there is breakthrough. The vacuum gauge on the flow restrictor would be monitored, with decreasing vacuum indicating that sub-slab soil gas was being collected into the Summa canister. All samples would be collected for approximately 2 to 30 minutes as determined by Wasatch personnel. Final vacuums would be recorded on the chain-of-custody form. The valves on the Summa canisters would then be closed, sample regulators removed, and brass caps tightened to the inlet of the sample canisters. The vapor pins would be removed from each hole and the holes would be filled and finished with concrete and/or concrete sealer. Summa canisters would be labeled with the appropriate sample location, as well as initial and final vacuum readings. Chain-of-custody documentation would be completed and the samples delivered to the analytical laboratory.

Samples will be packed, sealed, and shipped/transported in accordance with the **Sample Documentation and Handling SOP**; however, ice is not required for shipment/transport of sub-slab soil gas samples.

SOP 18 – SOIL GAS SAMPLING

Soil gas sampling provides an efficient means of detecting the presence of volatile organic compounds (VOCs) in subsurface soils. Using this method, VOC-impacted soil gas can be identified, and the source, extent, and movement of VOCs can be traced.

This standard operating procedure (SOP) outlines the methods used for the installation of soil gas monitoring wells and the sampling of soil gas monitoring wells and soil gas probes using passive samplers and/or negative vacuum (Summa) canisters.

The location and number of soil gas samples to be collected will be determined by Wasatch personnel to provide sufficient coverage, and will be based on the work plan objectives. Conditions not suitable for collection of soil gas samples include but are not limited to: a shallow water table (i.e., <3 feet), chemical(s) of concern is/are not volatile, or if moisture or unknown material is observed in the sample stream or sample container.

Active Soil Gas Sampling Method

Soil Gas Probe Installation

Slam Bar Method

1. The tip of the pilot hole rod is placed on the ground and the piston of the slam bar is used to drive the rod to the desired depth. The number of blows required to reach the desired depth is recorded in the field notebook.
2. After the boring is made, the slam bar is carefully withdrawn to prevent the collapse of the side walls.
3. The soil gas probe, with a capped section of Teflon-lined tubing attached, is carefully inserted into the boring. The probe is inserted to the full depth of the hole and then pulled up three to six inches, exposing the stainless steel screen.
4. The top of the sample boring is then sealed at the surface to prevent infiltration of ambient air. A golf-ball size portion of bentonite clay is kneaded until it becomes soft. The clay is carefully molded around the probe at the soil surface to seal the space between the probe and the annulus space of the boring.
5. Once sealed, the boring is allowed to equilibrate for a minimum of 30 minutes prior to sampling.
6. To ensure a representative soil gas sample, a discrete volume of gas is purged to rid the tubing of atmospheric air and allow the subsurface soil gas to enter the probe tubing. The volume of gas removed will be equal to the volume of the tubing used. Unlike groundwater sampling, purging of a soil gas probe is designed to remove only the ambient air within the tubing.
7. If semi-permanent soil gas sampling installation is required, the probe remains in the boring, which may be sealed by backfilling with clean sand, at least 4 to 6 inches above the top of the soil gas monitoring point, followed by a bentonite seal to the ground surface.

Power Hammer Method

1. A power hammer may be used to make borings when the soil is very hard, frozen or fine textured (clay), or when soil gas from beneath pavement or concrete is collected.
2. A power hammer is used to drive the probe to the desired depth (up to 12 feet may be attained with extensions). Threaded extensions are added, and securely fastened, until the desired depth is achieved.

3. After the boring is completed, the threaded rod is carefully withdrawn. This should be done in such a manner to prevent collapse of the side walls. If necessary, a jack retrieval assembly may be used to retrieve the rods.
4. The soil gas probe attached with a capped section of Teflon-lined tubing is then installed in the boring as described in Slam Bar method section, Steps 3, 4, and 5.
5. To ensure a representative soil gas sample, a discrete volume of gas is purged to rid the tubing of atmospheric air and allow the subsurface soil gas to enter the probe tubing. The volume of gas removed is determined by the volume of tubing employed in the probe. (Unlike groundwater sampling, purging of a soil gas probe is designed to remove only the ambient air within the tubing.)
6. If semi-permanent soil gas sampling installation is required, the probe remains in the boring, which may be sealed by backfilling with clean sand, at least 3 inches above the top of the soil gas monitoring point, followed by a bentonite seal to the ground surface.

Direct-Push Method

1. Direct-push drilling/sampling technology refers to soil gas samplers that are inserted into the ground without the use of slam bars or demolition hammers. Direct-Push units/tooling can be mounted on an all-terrain track mounted vehicles or other vehicles. These tools are able to collect samples at depths greater than 50 feet, depending on soil conditions.
2. Sampling probes, consisting of 3 to 5-foot sections of flush-threaded, 1¼-inch hardened steel alloy steel rod tipped by an expendable steel point, are driven into the ground to the target depth. The probe tools are withdrawn approximately 6 inches to 1 foot to release the expendable tip and allow soil gas to flow into the tool's tubing.
3. Once in-place, the boring is allowed to equilibrate for approximately 30 minutes prior to sampling.
4. To ensure a representative soil gas sample, a discrete volume of gas is purged to rid the tubing of atmospheric air and allow the subsurface soil gas to enter the probe tubing. The volume of gas removed is determined by the volume of tubing employed in the probe. (Unlike groundwater sampling, purging of a soil gas probe is designed to remove only the ambient air within the tubing.)
5. If semi-permanent soil gas sampling installation is required, the probe remains in the boring, which may be sealed by backfilling with clean sand, at least 3 inches above the top of the soil gas monitoring point, followed by a bentonite seal to the ground surface.

Passive Soil Gas Sampling Method

Passive soil gas methods consist of the burial of a sampling device, containing an adsorbent, in the ground with subsequent retrieval and analysis of the adsorbent. With passive sampling, there is no forced movement of soil gas. Instead, as the gasses migrate, the sorbent acts as a sink for the compounds in the soil gas. This method gives a time-integrated measurement and reduces the uncertainty due to temporal variations. Passive soil gas methods directly measure a mass of contaminant that has diffused onto an adsorbent media. Reporting units are typically in terms of mass (e.g., micrograms). Using relative mass levels, passive soil gas can be a viable, cost-effective, and simple screening tool to determine potential areas of concern.

Passive soil gas sampling generally involves drilling or probing a ½-inch hole at least 3-5 feet below ground surface. The passive sampler is inserted to depth using wire or string which is secured to the top of the boring, then the top of the boring is sealed with bentonite paste. The sampler will be deployed for the manufacturer recommended duration. After the recommended sample duration is complete, the

sorbent tube is retrieved and properly sealed as recommended by the manufacturer to preserve cleanliness to prevent additional adsorption during return shipment to the analytical laboratory.

Soil Gas Monitoring Wells

A soil gas monitoring point and tubing can be installed down a variety of boreholes ranging in diameter from 1 to 8-inch. Boreholes may be created with hand equipment (hand-augering) or direct-push systems (previously discussed). Installation of several tubes in the same borehole at varying depths (hereafter referred to as nested soil gas wells) are easier in boreholes >1.5-inches in diameter. It is assumed that utilities have been cleared and an open borehole exists. In situations where the borehole collapses; the same protocol can be followed down the probe rods, keeping care to not pull the tubing out when the rods are retracted and to add grouting materials as the rod is removed.

1. Measure depth to bottom of the borehole.
2. Cut Teflon-lined tubing to the appropriate length to give enough surface length for required type of surface termination (flush, recessed, protruding), then attach the soil gas monitoring point to the end of the tubing.
3. Add about 2 inches of sand to bottom of borehole (calculate required volume based upon borehole diameter).
4. Insert Teflon-lined tubing with the soil gas monitoring point down the borehole. Cover the soil gas monitoring point with at least 4 to 6 inches of sand.
5. If a single depth soil gas well, grout to the surface using bentonite for semi-permanent well. If permanent installation, bentonite to near surface and complete with a cement pad and metal well vault.
6. For nested wells, add bentonite grout, hydrating periodically, to the next sample depth. Repeat steps 2, 3, 4, and 6 until all sample depths are completed.
7. Cut the protruding lengths of tubing successfully shorter so the deepest sample tube is the longest length and the others progressively shorter. This is helpful if the labels on each tube are lost or illegible upon resampling.
8. Label each tube before installing the next tube.
9. Terminate surface ends of tubes with Swagelok caps, valves, or other desired terminations.
10. Allow each well to equilibrate for 24 to 72 hours prior to sampling.

Sampling

Negative Vacuum (Summa) Canisters

Techniques for collecting the soil gas samples will begin by checking for a vacuum in each 6-liter Summa, 1-liter Summa, or 400-milliliter Summa canister supplied by the analytical laboratory. A sample regulator with a flow restrictor will be provided by the laboratory. The sample regulators will be attached to each Summa canister. Because the Teflon tubing is directly connected to the soil gas screen and the sample regulator, a shut-in test is performed by applying an air tight cap to the inlet of the regulator (after being attached to the Summa canister) then observing the vacuum gauge attached to the sample regulator for five minutes to verify that a decrease in vacuum is not observed. A decreasing vacuum would be indicative of a leak. If a leak is indicated, all connections in the sampling train would be checked and

tightened as necessary. The shut-in test would then be repeated. Following successful completion of the shut-in test, one tubing volume from each sampling location will then be purged using a pump, and then attached to the sample regulator and the valve on the sample canister will be opened. A tracer will be applied to the collection system by placing isopropyl alcohol pads near all connection points (except for the screen connection for the slam bar, power hammer, or direct push sampling methods) to verify sample integrity and identify if a leak in the system has occurred. Breakthrough would be indicated if isopropyl alcohol is detected at a concentration greater than or equal to a 1 percent concentration reported with the laboratory analytical results for the sample. The vacuum gauge on the flow restrictor will be monitored, with decreasing vacuum indicating that soil gas is being collected into the Summa canister. All samples will be collected for approximately 2 minutes to ½ hour as determined by Wasatch personnel. Final vacuums will be recorded on the chain-of-custody form. The valves on the Summa canisters will then be closed, sample regulators removed, and brass caps tightened to the inlet of the Summa canisters. Summa canisters will be labeled with the appropriate sample location, as well as initial and final vacuum readings. Chain-of-custody documentation will be completed and the samples delivered to the analytical laboratory.

Samples will be packed, sealed, and shipped/transported in accordance with the **Sample Documentation and Handling SOP**; however, ice is not required for shipment/transport of soil gas samples.

SOP 19 – INDOOR AIR SAMPLING

Prior to collecting indoor air samples the site occupants would be interviewed to ascertain whether or not dry cleaned clothing has been brought into the structure, or carpets have been professionally cleaned, within the preceding two weeks. Additionally, the occupants would be interviewed to ascertain what recent activities have been conducted at the site, and if any known products containing the chemicals of concern are present. Next a chemical inventory would be performed to identify and remove any products containing chemicals of concern (any volatile organic compounds [VOCs], unless the list of analytes has been limited to specific VOCs with approval of the regulatory agency) within the site structures of concern. This procedure would be followed to reduce the potential for false positive results in the indoor air samples (i.e., the detection of chemicals of concern in the indoor air samples resulting from sources inside the structure rather than from beneath the floor slabs). Products discovered during the chemical inventory that contain chemicals of concerns would be removed from the structure for a minimum of two weeks prior to sampling activities. All products would be documented in a field notebook or on the Indoor Air Sampling and Chemical Use Questionnaire.

The location and number of indoor air samples to be collected will be determined by Wasatch personnel to provide sufficient coverage, and will be based on the specific objectives, structure configuration, and structure size. The specific number and location of samples, as well as the analyte list, would be specified in the Sampling and Analysis Plan or work plan for specific phases of investigation.

Techniques for collecting the indoor and outdoor air (ambient background sample) samples would begin by checking for a vacuum in each 6-liter Summa canister supplied by the laboratory. Initial vacuums would be recorded on the chain-of-custody form. A 6-liter Summa canister would then be placed at an appropriate height for sample collection at each sample location. The sampling locations and heights will be specified in the work plan for specific investigations, but will generally be placed at breathing space height whenever possible and appropriate with respect to the sampling objectives. A sample regulator with a flow restrictor would be provided by the laboratory for each sample location. A sample regulator would be attached to each 6-liter Summa canister. The vacuum gauge on the flow restrictor would be monitored, with decreasing vacuum indicating that ambient indoor air is being collected into the sample canister. All samples would be collected for approximately 8 hours for commercial structures, and 24 hours for residential structures. Final vacuums would be recorded on the chain-of-custody form provided. The valves on the sample canisters would then be closed, sample regulators would be removed, and the brass caps tightened to the inlet of the sample canisters. Canisters would be labeled with the appropriate sample location, as well as initial and final vacuum readings. Chain-of-custody documentation would be completed and the samples would be delivered to laboratory for the appropriate analysis.

Samples will be packed, sealed, and shipped/transported in accordance with the **Sample Documentation and Handling SOP**; however, ice is not required for shipment/transport of indoor air samples.

SOP 20 – METAL DETECTORS AND MAGNETOMETERS

Metal detectors will be used to locate buried metallic objects by sweeping the sensor immediately above the ground surface. When an object is detected, a shovel or other equipment will be used to locate the buried object or the object will be surveyed.

Magnetometers will be used to locate buried ferrous-metallic objects. The magnetometer survey will be performed in a grid pattern within the anticipated search area. The magnetometer operator will determine the initial grid. If an anomaly is found, the grid spacing may be reduced. The spacing will determine the resolution of the data. The magnetometer contractor will conduct the survey with the site geologist or other competent personnel providing oversight. The magnetometer points will be surveyed in accordance with the **Exploration Point Surveying SOP**.

SOP 21 – GROUND-PENETRATING RADAR

Ground-penetrating radar (GPR) uses high frequency radio waves to acquire subsurface information (buried metal objects, boundary or interface conditions). The GPR survey area will be delineated into a grid pattern by stakes or other marking devices. The spacing of lines on the grid is a function of the resolution required for geophysical data or the size of the object(s) to be located; the tighter the grid pattern, the more detailed the information, and the wider the pattern, the faster the survey can be completed. The GPR contractor will determine the grid pattern. Subsurface profiles are acquired by towing the antenna along the grid lines to obtain the data (first along all of the lines in one direction and then along the perpendicular lines), thus creating a map of the site. The geophysical contractor will conduct the ground-penetrating radar survey with the site geologist or competent personnel providing oversight.

SOP 22 – DECONTAMINATION

Equipment used to advance soil borings, and obtain soil and groundwater samples, will be decontaminated to avoid cross-contamination. Downhole equipment will be pressure-cleaned with potable water and Alconox® (or other equivalent cleaner) before drilling and sampling of each borehole. The cleaning of equipment will typically be performed at the site.

Bailers, submersible pumps and other non-dedicated miscellaneous equipment, that contacts analytical soil or groundwater samples, will be decontaminated or replaced with new material before and between each sampling event. Equipment of this type may be decontaminated by cleaning, when convenient, but is typically decontaminated using the following three-step procedure:

- Laboratory-grade detergent, such as Alconox®, and potable water wash
- Potable water rinse
- Triple rinse with distilled water or deionized water

Spray bottles may be used to store and apply the distilled or deionized water. If necessary, sampling equipment will be wrapped with aluminum foil to protect the equipment from dust or vapors between use. Liquids generated during the decontamination process will be handled according to the **Management of Investigation-Derived Waste SOP** when required.

SOP 23 – MANAGEMENT OF INVESTIGATION-DERIVED WASTE

Investigation-derived waste (IDW) generated during investigation operations will include sanitary waste (label backs, paper towels, etc.), used personal protection equipment (PPE), soil cuttings, decontamination water, purge water, and well development water.

Container Management and Labeling

Waste containers will be identified with the solid waste origination location(s), boring and/or sampling location(s), and date generated. The information will be written directly on the containers or written on labels that are affixed to the containers. If labels are used, labels indicating Analysis Pending will be affixed to each drum until such time as the waste has been properly characterized. Once the waste has been characterized, the Analysis Pending label will be replaced with either a Non-Hazardous Waste label or a Hazardous Waste label, as appropriate. If a Hazardous Waste label is used, the label will be fill-out completely including the appropriate waste code(s) and generator information. Hazardous waste will be stored in a secured area with appropriate signage, and will be properly transported and disposed within 90 days of generation. All hazardous waste containers will be photographed after they have been characterized, identified, labeled, and stored to document proper labeling and storage. These data will be documented in a field notebook, by field personnel. The containerized IDW will be inspected as deemed necessary to ensure that the integrity of the containers is maintained and that the material has not been removed from the designated storage location.

Sanitary Waste and Personal Protective Equipment

Sanitary wastes, including used PPE generated at each investigation location, will be collected in plastic bags or equivalent containers and sealed. The waste will be disposed as municipal waste. As necessary, soil and loose material will be brushed off or otherwise removed from the PPE at the site before containerizing the PPE.

Soil Cuttings

Soil cuttings will be placed in 55-gallon drums and left on-site pending analytical results. The concentrations of soil within the containers will be determined using the soil sample data from the soil boring locations or by waste characterization sampling from the drums. Soil concentrations will be used to determine if the containerized soil must be transported off-site for disposal, or if the soil may be disposed on-site.

Decontamination Fluids, Purge Water, and Development Water

The accumulation area for decontamination water, purge water, and well development water will be located on-site. The water will be containerized and stored in areas preferably out of site from the general public. Analytical data associated with the generation of the IDW water, historical data for the locations associated with the IDW, or waste characterization samples will be reviewed or collected to determine the appropriate disposal options for the IDW.

SOP 24 – SITE RESTORATION

All exploration point locations will be restored, to the extent possible, to the previous existing condition. Borings will be backfilled in accordance with the **Borehole Abandonment Procedures SOP**. The need to repair the ground surface at boring locations will be assessed by Wasatch personnel and the client prior to sampling activities. If repair is required, borings made through asphalt will be patched with asphalt, concrete will be patched with concrete, and soil or gravel areas will be covered with like material.

SOP 25 – DOCUMENTATION

Documentation guidelines are intended to ensure that complete and consistent written records are maintained throughout the field activities. The field documents will be reviewed for accuracy and will remain available to field personnel at the site, during field activities. In addition, photographs will be taken in the field to document activities and conditions.

All field activities will be recorded in field notebooks. Notebooks will contain descriptions of daily field activities. Information to be recorded in logbooks includes the following, as appropriate:

- Photoionization detector readings, odors, and other readings pertaining to air quality
- Quality assurance and quality control sample identification
- Daily site conditions including temperature and weather
- Personnel present on-site, including time that they entered the site
- Calibration information
- Subcontractor activities
- Samples collected
- Well development
- Descriptions of field tests
- Equipment used
- Decontamination procedures
- Problems encountered
- Decisions
- Phone records
- Chain-of-custody information

Notebook entries will be made with ink. Corrections will be made by drawing a single line through the entry, initialing, and dating the revision if necessary.

Some field data will be recorded on the specialized forms. These data will typically not be duplicated in the field logbooks; however, reference to the forms will be recorded in the logbooks, as appropriate.

SOP 26 – SURVEYING OF SAMPLE LOCATIONS

Monitoring wells and piezometers will be topographically surveyed by a Utah Licensed surveyor using established vertical and horizontal control points.

The casing and ground surface elevation for monitoring wells will be surveyed by a Utah licensed surveyor to within ± 0.01 feet using the current industry accepted vertical datum. The top of the casing (not protective case) for monitoring wells and the ground surface will be surveyed. Horizontal coordinates will be determined to within ± 0.1 feet and reported in coordinates that are specified in the work plan.

Survey field data (as corrected) for monitoring wells will include loop closure for survey accuracy and raw survey data. Closure will be within the horizontal and vertical limits given above. This submission will clearly list the coordinates (and system) and elevation (ground surface and/or top of well casing, as appropriate) for all borings, wells, and reference marks. All permanent and semi-permanent reference marks used for horizontal and vertical control (bench marks, caps, plates, chiseled cuts, rail spikes, etc.) will be described in terms of their name, character, and physical location.

The on-site representative will be responsible for coordinating the survey crew activities but may or may not conduct oversight or supervision of the survey crew while field work is conducted. A set of keys will be supplied to the survey crew by Wasatch or the client to allow access to any locked gate or monitoring wells. The survey crew will return the keys to the on-site representative or client after survey work is completed.

The surveying of other types of sample locations will be conducted as needed. Other types of sample locations may include soil boring locations, surface water sampling, sediment sampling locations, and shallow/surface soil sampling locations. The surveying requirements for these types of sample locations are similar to the requirements for surveying monitoring wells. However, there will be no top-of-casing elevation and the accuracy for ground surface elevation measurement will be to within ± 0.1 feet rather than ± 0.01 feet. Some sample grids and locations may be located by Wasatch field personnel using a sub-meter grade global positioning system (GPS) or laser surveying equipment, as specified in works plans and/or sampling and analysis plans.

SOP 27 – SAMPLE DOCUMENTATION AND HANDLING

Sample collection information will be entered into field notebooks. Prior to laboratory shipment, each sample will be logged on a Chain-of-Custody (COC) Form. The COC form will be placed in a cooler and will accompany the analytical samples during shipment or transport to the laboratory.

Once sealed, sample bottles will be labeled and placed in an iced cooler. Coolers to be shipped via courier will be lined with a plastic bag and packed with packing material surrounding the bottles to prevent breakage during shipment. Additionally, the drain spout of the cooler will be taped shut. Ice will be sealed in plastic bags to prevent melted ice from soaking the packing material. A temperature blank may be included in each cooler. A COC form will be enclosed in sealed plastic bags and taped to the underside of the cooler lid. Coolers will be secured with strapping tape and custody seals. The custody seals will be affixed to each sample cooler (not each bottle). The coolers will be shipped or delivered to the appropriate laboratory, by the field technician or overnight courier, so they will arrive for analysis within 3 days of sample collection.

SOP 28 – CHAIN-OF-CUSTODY DOCUMENTATION

A required part of any sampling and analytical program is a system for sample control from collection to data reporting. This includes the ability to trace the possession and handling of samples from the time of collection through analysis and final deposition. This system also ensures against tampering or contamination of samples. The documentation of the sample's history is referred to as the chain of custody (COC). Initially after collection, a sample is considered to be under a person's custody if it fits the following criteria:

- In an individual's possession
- In view of the individual after that person has taken possession
- Secured by the person so that no one can tamper with the sample

The field technician will use COC forms that are equivalent to the U.S. EPA Office of Enforcement COC forms. The sequence for transferring samples from the possession of the sampler, as cited above, to the contract laboratory is as follows:

When the sample bottles are delivered from the laboratory, both the sender and receiver sign and date the COC form as well as specifying on the form what has changed hands. From that point on, every time the sample bottles change hands (whether empty or full) both parties sign and date the transfer. However, some sample bottles are stored at Wasatch and no COC is required for the acquisition of the sample bottles.

The following information is included on the COC:

- Project number
- Project name
- Sample ID number (as noted in the field log book) secured by that person so no one can tamper with the sample
- Signature of sampler
- Date and time of collection (time logged in field log book)
- Type and matrix of sample
- Number of containers
- Preservative
- Requested analyses
- Inclusive dates of possession
- Signature of receiver

In addition to the COC form, other components of the COC will include sample labels, custody seals (if shipping the samples to a laboratory), and field notebook, as summarized below:

Sample Label. A sample label will be affixed to each sample bottle to provide information regarding the sample ID, sampler's initials, analytical tests to be performed, preservative information, date, and time of sample collection.

Custody Seals. Two custody seals will be affixed to each sample shipping container (not each bottle). These seals will show a sampler's (or person in possession of the samples) name, and date sealed. The seals will be taped onto the sample shipping container or lid of the shipping container prior to sample shipment, and will be broken at the laboratory under COC procedures.